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Colchicine Bibliography III

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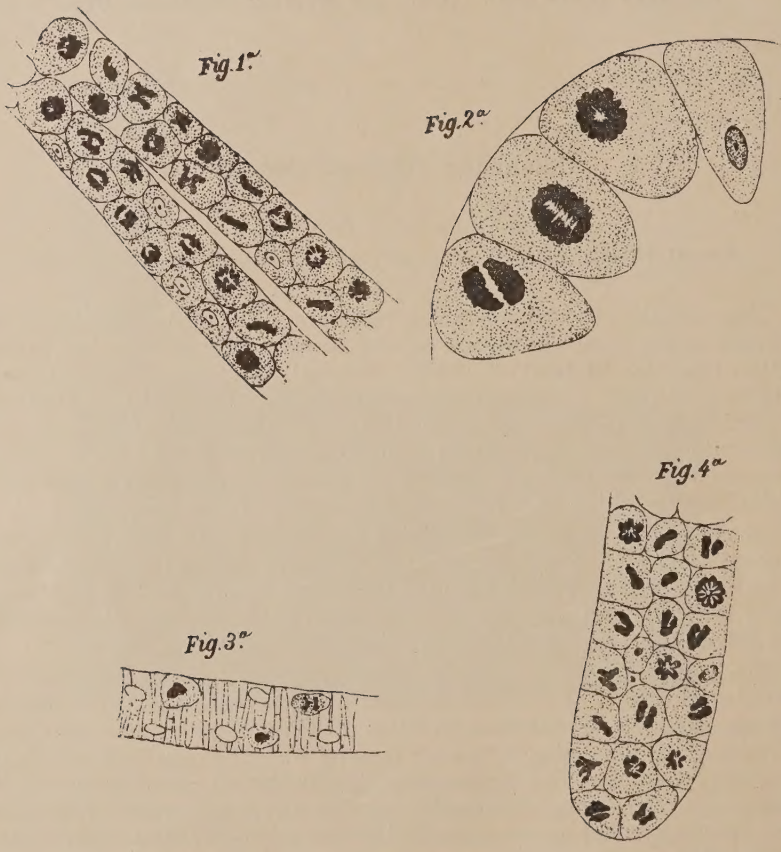
This addition to the colchicine bibliography, prepared to facilitate a review of the recent literature on this subject, supplements the earlier edition (Lloydia **10**: 65–114, 1947). Primarily papers published during 1947 and 1948 are included in this instalment. Titles of contributions of colchicine published prior to 1900 have been selected from the Index-catalogue of the Library of the Surgeon General's Office. Many of these works have historical value only and do not deal with colchicine in relation to more recent research on this subject.

Much colchicine research originated in the Brussels Laboratory directed by the late Professor A. P. Dustin, Sr. At the time of his death he had an extensive review of this subject in preparation. Fortunately one of us (P. Dustin, Jr.) was able to continue this work uninterruptedly and extend the research program initiated by the elder Dustin.

The authors wish to thank their numerous correspondents who contributed titles and copies of publications otherwise difficult to obtain, and are particularly indebted to Miss N. Gay-Winn for her assistance in locating the first scientific paper dealing with the effects of colchicine on animal tissues. The accompanying illustration is taken from this source. Furthermore, incorrectly or incompletely cited references have been corrected or completed with the help of various contributors to the bibliography.

For the past two years the authors have collaborated on a monograph dealing with colchicine from the standpoint of animal and plant cytology. Specialists have been invited to contribute chapters on certain phases. The preparation of a bibliography as complete as possible constitutes a major part of the necessary preliminary work. Any new and old titles not contained in the various instalments of this bibliography should be called to the attention either of P. Dustin, Jr., 97 aux Laines, Brussels, Belgium, or O. J. Eigsti, 1005 Hovey Avenue, Normal, Illinois, U. S. A.



FIGS. 1a–4a. Reproduced from Pernice, B.—Sulla cariocinesi nella gastro-enterite acuta. La Sicilia Medica **1**(4): 265–279. 1889.

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Supplement[1]

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(*Institute for Food-Science, Kyoto University, Kyoto, Japan*)

ABE, S. Parthenogenesis induced by the pollination of diploid pollens. Ikusyu-Kenkyu **1**: 135–137. 1942.

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[1]Prof. I. Nishiyama kindly furnished a list of papers not included in the original list of 1947. The list of papers submitted is here appended. The following notations were used:

*written in Japanese with English or German titles.

**written in Japanese with English or German title and résumé.

†written in Japanese, titles translated by Prof. Nishiyama.

*HOSODA, T. On the fertility of *Raphanus-brassica* and *Brassico-raphanus* obtained by colchicine treatment. Jap. Jour. Genet. **22**: 52–53. 1947.

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Notes on Venezuelan Fungi

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The first systematic study of the fungi of Venezuela was made by Patouillard and Gaillard (1888). Of the 278 species which they catalogued, 124 were regarded as new to science. Forty years later, Sydow visited Venezuela and reported (1930) having collected 316 species, 116 of which he regarded as previously undescribed.

An extensive survey of the fungus flora of Venezuela was conducted by Chardon and Toro (1934) during the period 1930–1932. Their report includes a bibliographic and historical resumé of Venezuelan mycology, according to which various collectors had previously gathered a total of 643 species. To this number Chardon and Toro added 518 species, thus bringing to 1,161 species the total number collected in Venezuela. These species as classified and grouped by Chardon and Toro include the following: Myxomycetes 22 species, Phycomycetes 18 species, Discomycetes 33 species, Hemisphaeriales 45 species, Perisporiales 85 species, Hypocreales 38 species, Dothideales 84 species, Fimetariales 5 species, Sphaerilaes 58 species, Xylariaceae 68 species, Ustilaginales 18 species, Uredinales 184 species, Hymenomycetes 268 species, Gastromycetes 22 species, and Fungi Imperfecti 206 species.

Subsequently several investigators, notably A. S. Müller, H. H. Whetzel, and M. F. Barrus, focussed special attention on collecting plant pathogenic species. It has not been possible to check their collections to determine how many additions they made to the previously known list of 1,161 species. Their specimens* have been deposited, however, in El Ministerio de Agricultura y Cría, Departamento de Fitopatología, Maracay, Venezuela, whereas duplicates are among the collections at Cornell University.

Some appreciation of the content of these collections may be gained from an annoted list, published by Müller and Chupp (1942), comprising 176 species of Cercospora, 29 of which are new to science. Müller (1941) also states that during the period 1931–1941 approximately 350 pathogenic species were identified. Among them are such well-known organisms as *Guignardia bidwellii*, *Phakopsora vitis*, and *Cercospora viticola* on grape; *Cercospora musae* and *Gloeosporium musarum* on banana; *Ustilago zeae* and *Puccinia sorghi* on corn; *Leptosphaeria sacchari* and *Ligniera vascularum* on sugar cane; *Corticium koleroga*, *Cercospora coffeicola*, and *Omphalia flavida* on coffee; *Piricularia oryzae*, *Entyloma oryzae*, and *Cercospora oryzae* on rice; *Marasimus perniciosus* and *Diplodia cacaoicola* on cacao; *Peronoplasmopara cubensis* on cucumber; and *Asperisporium caricae* on papaya.

*The total number of collections made by Müller, Whetzel, and Barrus is 4,263 specimens according to a multicopied list recently prepared under the direction of Dr. C. H. Meredith.

As time permitted during the period from October, 1947, to May, 1948, the writer made collections of fungi together with observations on incidence of pathogenic species in parts of the following States: Barinas, Portuguesa, Cojedes, Lara, Yaracuy, Carabobo, Guárico, Arágua, Distrito Federal, Miranda, Anzoátegui, Monagras, and Sucre. The following account deals with the identity of these fungi and the incidence of the more common diseases. Grateful acknowledgment is made to Dr. G. B. Cummins for identifying the rusts, Dr. J. H. Miller for identifying the Pyrenomycetes, and Dr. J. A. Stevenson for identifying the Hymenomycetes.

GENERAL IMPRESSIONS RELATIVE TO PLANT DISEASES IN VENEZUELA

The losses to crop plants due to viruses and pathogenic fungi are proportionally large in Venezuela. Apparently temperature, soil moisture, and the distribution of rainfall, as interrelated with atmospheric humidity and rate of evaporation and transpiration, are potent contributory factors of disease incidence. The full impact of such interrelations can best be appreciated only after first-hand experience in the tropics. Stresses on the vigor of plants and their resistance to diseases are imposed by moisture, which is excessive in the rainy season and completely insufficient in the dry season. Also the practices employed there in cultivation, drainage, and irrigation are quite empirical, and are not always best suited to provide for adequate soil aeration and the development of plant roots. Moreover the cultivation practices, generally employed, during the dry season are not especially designed to diminish or retard excessive water loss by evaporation.

Of the total area of Venezuela (1,043,900 square kilometers), the portion under cultivation does not greatly exceed one per cent. The arable lands, exclusive of those used for coffee culture, are constituted, for the most part, of alluvial river valleys and lower slopes of the mountains. Hence marked differences in temperature occur in places not far distant from each other, as, for example, in the valley and on the higher elevations of near-by mountains. These differences may be quite extreme as shown by the fact that the time required for growing corn in the higher altitudes may be approximately twice as long as that in the valleys, a few kilometers distant.

Delimitation of life zones in Venezuela on the basis of altitude has been stressed by several investigators. Pittier (1926) indicated that the tropical zone (tierra caliente) extends from sea-level to elevations approximating 800 meters, the subtropical zone (tierra templada), from 800 to 2000 meters, and the temperate zone (tierra fria) from 2000 to 3000 meters. Not only does altitude impose limits on the range of natural vegetation but also on that of cultivated crops, and moreover such altitudinal effects are reflected in the incidence and severity of diseases. Coffee grown at elevations of 1500 meters or higher may be quite free from attack by *Omphalia flavida*, *Corticum koleroga*, and *Cercospora coffeicola* whereas these pathogens are abundant in the lowlands. It is well known also that dense shade together with high relative humidities predispose coffee to attack by these pathogens.

Omphalia flavida is of special interest because the leafspots which it produces on coffee and various other plants are luminous. Ernst

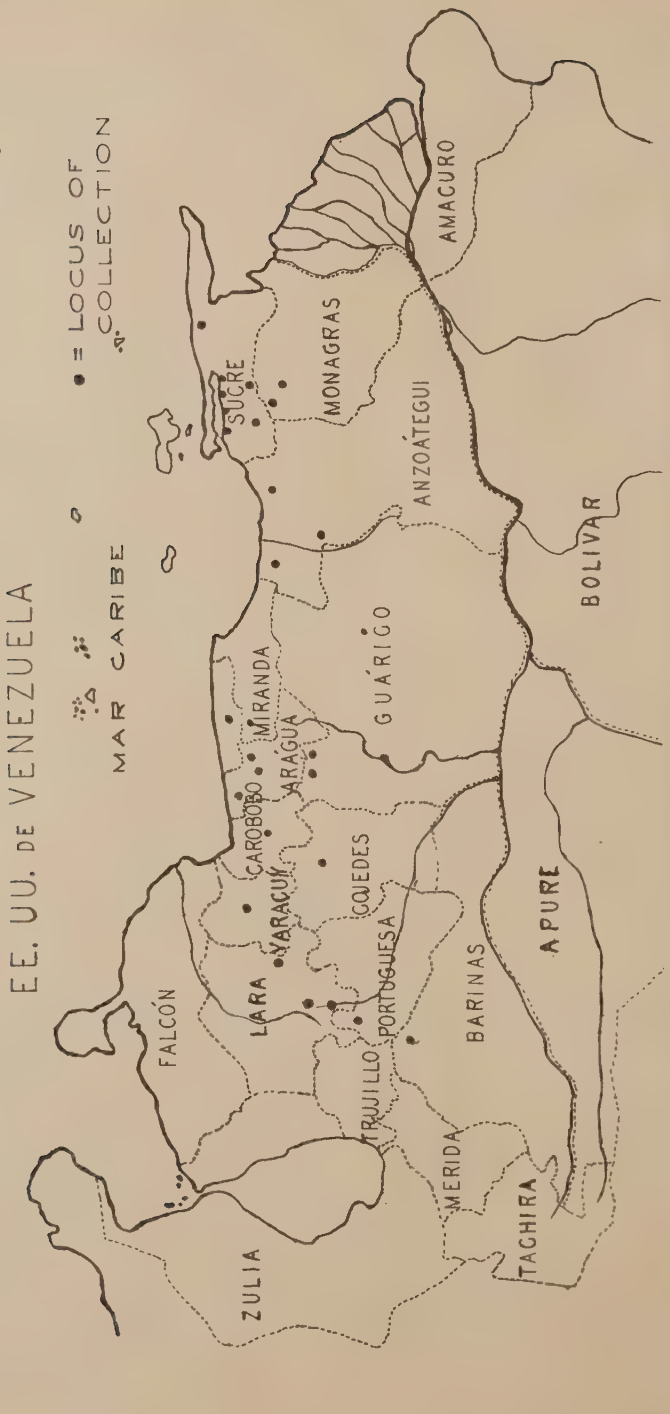

FIG. 1. Map showing points in Venezuela at which collections of fungi were made in the states north of the Orinoco river.

(1876) noted this fact years ago and called the disease "candelilla" (little candle).

The species of sooty molds (Perisporiaceae) are abundant and widespread in Venezuela as is known to be the case in other tropical regions. This fact is indicated by the numerous species in the collections by Sydow (1930) and Chardon and Toro (1934). On the other hand, the powdery mildews (Erysiphaceae) are rare. The writer collected powdery mildews in the conidial stage on four hosts only, grapes, roses, periwinkle, and *Sclerrocarpus coffeaecola* (flor amarilla). Toro states (Chardon and Toro, 1934) that the powdery mildews do not occur in the perfect stage in the tropics but only in the conidial stage.

The witch-broom disease, caused by *Marasmius perniciosus*, is a serious menace to cacao which is planted in low-lying coastal areas especially near the mouths of rivers.

Areolate mildew, attributed by Ehrlich and Wolf (1932) to *Mycosphaerella areola* is best known as *Ramularia areola*, its conidial stage. This fungus is so abundant that it causes severe premature defoliation of cotton throughout Venezuela wherever this crop is cultivated, whereas in the United States this disease is not of economic importance. Imported cotton seed that has been treated with proprietary disinfectants yields a crop which is free from areolate mildew. Cotton is best grown during the rainy season at which time the weather is most favorable for areolate mildew. If the cotton harvest has been completed early after the end of the rainy season, cotton may again flower and such plants may produce a dry-season crop which then remains quite free from this disease.

Diseases of seedlings grown in seedbeds, especially tobacco seedlings, may be prevalent during the rainy season to the extent that serious losses are encountered. The soil-inhabiting organisms involved as causal agents are species of Rhizoctonia, Pythium, Sclerotinia, and Phytophthora. Soils which are periodically saturated, due to poor drainage, flooding, or torrential rains, are essential for the development of diseases by these fungi.

In areas flooded by rains or by improper irrigation such crops as beans, cowpeas, soybeans, egg plants, peppers, cotton and tobacco are subject to root rot induced by *Macrophomina phaseoli*. As tobacco approaches maturity the plants are killed to the extent that severe losses may occur.

In Venezuela diseases induced by species of Cercospora become abundant during the dry season both on wild plants and cultivated species. It is generally believed by plant pathologists that dry weather is a potent factor in the incidence of diseases associated with Cercospora. *Sesamum indicum* (ajonjoli) may be severely attacked by *Cercospora sesami*, stems, leaves, and capsules being involved.

Seedlings of Burley tobacco, a variety especially susceptible to *Cercospora nicotianae*, may become copiously spotted under conditions which indicate that this pathogen is seed-borne.

Cercospora musae, which has been shown by Leach (4) to be the conidial stage of *Mycosphaerella musicola*, has been widely reported throughout the Tropics. In Venezuela it is universally present on the various kinds of bananas and no evidence of specific and varietal differences in susceptibility were noted.

In general, the native or criollo varieties of tobacco appear less subject to root-rots and leafspots than are the Virginia types and Burley types. Such resistance among native tobaccos might well prove to be valuable in hybridization. Similarly, native varieties of corn are more drought resistant and appear also to be more resistant to root-rots than are those imported from the United States, suggesting that use should be made of native stocks in the improvement of corn by hybridization.

A recent report by Ciccarone (1949) directs attention to an epiphytotic of late blight of potatoes, *Phytophthora infestans*, in the Aragua Valley. His data show that periods occur at night when temperature and humidity are favorable for germination of the zoospores and for infection. In this same area *Phytophthora nicotianae* may cause serious losses to tobacco both in seedbeds and in the field unless blackshank resistant varieties are planted.

Among the commonly-encountered virus diseases, each of which causes grave losses, mention is made of sugar cane mosaic, ordinary mosaic and leaf-curl of tobacco, leaf-curl of tomato, yuca mosaic, and top necrosis of papaya.

List of Fungi

PHYCOMYCETES

1. *Olpidium brassicae* (Wor.) Dangeard. On seedlings of *Nicotiana tabacum* L.
   Carabobo: Miranda, Montalban, Bejuma. Arágua: Turmero, Cágua. Guárico: San Juan de los Morros.

Groups of seedlings remain dwarfed until the seedbed covers have been removed after which they soon appear to become normal.

2. *Physoderma zeae-maydis* Shaw. On *Zea mays* L.
   Arágua: Maracay. Portuguesa: Guanare.
3. *Pythium de Baryanum* Hesse. On seedlings of *Nicotiana tabacum* L. A cause of damping-off. Occurs widely in the States of Arágua, Carabobo, Dist. Federal, Guárico, and Miranda.
4. *Phytophthora infestans* (Mont.) de Bary. On *Solanum tuberosum* L.
   Dist. Federal: In truck gardens at El Paraiso near Caracas.

Within a few days after onset of the disease, entire fields were involved.

5. *Phytophthora nicotianae* Breda de Hahn. On *Nicotiana tabacum* L.
   Arágua: Turmero, Cágua, Santa Cruz.

A high degree of resistance is shown by plants from resistant varieties, such varieties having been developed in North Carolina and Virginia.

6. *Albugo bliti* (Biv.) O. Kuntze. On *Amaranthus spinosus* L. (pira brava).
   Arágua: Maracay.
7. *Albugo brasiliensis* (Speg.) P. Henn. On *Ageratum conyzoides* L. (Pompe zaragüellos).
   Miranda: Baruta.
8. *Albugo ipomoeae-panduranae* (Farl.) Swingle. On *Ipomoea batatas* (L.) Lam. (batata).
   Carabobo: Miranda. Miranda: Cua.

9. *Albugo platensis* (Speg.) Swingle. On *Boerhaavia erecta* L.
Arágua: Maracay.
On *Mirabilis jalapa* L. (pasaña). Sucre: Cumaná.

10. *Albugo portulaccae* (DC.) O. Kuntze. On *Portulacca oleracea* L. (verdolaga).
Arágua: Maracay. Guárico: San Sebastian.

11. *Peronospora parasitica* (P.) B. and C. On *Brassica oleracea* L. (repollo).
Arágua: La Victoria.

This pathogen produced necrotic spots on the lowermost leaves of plants ready to be harvested.

12. *Plasmopara viticola* (B. and C.) de Toni. On *Vitis vinifera* L. (uva).
Arágua: Maracay. Carabobo: Valencia.

13. *Pseudoperonospora cubensis* (B. and C.) Rost. On *Cucumis sativus* L. (pepino).
Arágua: Maracay. Sucre: Cumaná.
On *Cucumis melo* L. (melon). Arágua: Maracay.
On *Cucurbita maxima* Duchesne. (Auyama). Arágua: Maracay.

14. *Choanephora cucurbitarum* (B. and Rav.) Thaxter.
On *Hibiscus rosa-sinensis* L.—On *Hibiscus esculentus* L. (quimbombo).—On *Brassica oleracea* L. (repollo).
Arágua: Maracay, La Victoria. Dist. Federal: Caracas.

This fungus is so abundant that one wonders why it has previously been overlooked by mycologists.

ASCOMYCETES

1. *Amphisphaeria rochae* Theiss. On decaying wood.
Arágua: Rancho Grande.

2. *Camillea poculiformis* (Mont.) Lloyd. On dead wood.
Arágua: Rancho Grande.

The asci of this peculiar fungus disintegrate so that the masses of powdery spores come to occupy the stromatic locules.

3. *Diplocarpon rosae* Wolf. On *Rosa* spp.
Arágua: Maracay. Dist. Federal: Caracas. Sucre: Cumaná.

Only the conidial stage *Marssonia rosae* was seen and it is of common occurrence.

4. *Guignardia bidwellii* (Ell.) Viala and Ravaz. On *Vitis vinifera* L. (uva).
Carabobo: Valencia.

5. *Hypoxylon truncatum* (Schw.) Miller. On wood.
Arágua: Rancho Grande.

6. *Mycosphaerella areola* Ehrlich and Wolf. On *Gossypium hirsutum* L. (algodon).
Arágua: Maracay, Turmero, Cágua, Palo Negro. Sucre: Carúpano, Cumaná.

By the end of the rainy season the conidial stage of this fungus has caused severe defoliation. Spermogonia were found on fallen leaves.

7. *Sphaerella opuntiae* E. and E. On *Opuntia* spp. (tuna).
Sucre: Carúpano.

Very abundant on the several species of platyopuntias.

8. *Rosenscheldia paraguana* Speg. On *Hyptis suaveolens* Poit. (mastranto).
   Arágua: Las Palomas. Sucre: Santa Maria.

This fungus commonly causes a witches' broom disease on this mint in the Sabanas and Llanos.

9. *Sclerotinia ricini* Godfrey. On *Ricinus communis* L. (ricino).
   Arágua: Maracay.

This fungus may interfere with normal yields by attacking the flowers and fruits.

10. *Sclerotinia sclerotiorum* (Lib.) Schroet. On *Nicotiana tabacum* seedlings.
    Arágua: Turmero, Cágua.
    Guárico: La Villa de Cura.
11. *Sphaerotheca pannosa* (Wallr.) Lév.
    Dist. Federal: Caracas. Sucre: Cumaná.
12. *Uncinula necator* (Schw.) Burrill. On *Vitis vinifera* L. (uva).
    Carabobo: Valencia.

UREDINALES

1. *Cerotelium fici* Arthur. On *Ficus carica* L. (higuera).
   Arágua: La Victoria. Yaracuy: San Felipe.
2. *Phakopsora vitis* (Syd.) Arth. On *Vitis vinifera* L.
3. *Puccinia cannae* (Wint.) P. Henn. On *Canna indica* L.
   Sucre: Cumaná. Dist. Federal: Caracas.

The specimens show the uredinial stage onlv.

4. *Puccinia cenchri* Diet. and Holw. On *Cenchrus echinatus* L. (cadillo).
   Arágua: Maracay.
5. *Puccinia euphorbiae* P. Henn. On *Euphorbia cotinifolia* L.
   Arágua: Rancho Grande.
6. *Puccinia purpurea* Cke. On *Sorghum halepense* (L.) Pers.
   Arágua: Maracay. Lara: Barquisimeto.
7. *Puccinia sorghi* Schw. On *Zea mays* L.
   Arágua: Cágua, Turmero, La Victoria, Maracay, San Sebastian, Santa Cruz. Guárico: San Juan de los Morros. Portuguesa: Guanare. Sucre: Carúpano, Casanáy.

This rust is widespread and very abundant.

8. *Uromyces appendiculatus* Fr. On *Phaseolus vulgaris* L. (caraota).
   Arágua: San Mateo, La Victoria, Turmero, Maracay. Sucre: Cumaná, Santa Maria.
9. *Uromyces dolicholi* Arth. On *Cajanus indicus* Spreng. (quinchoncho).
   Sucre: Coccojar, Cumanacoa. Arágua: Maracay.
10. *Uromyces prominens* (DC.) Pass. On *Chamaesyce hirta* L.
    Arágua: Maracay.
11. *Uromyces superfixus* Vestergr. On *Bauhinia mirandia* Pittier.
    Yaracuy: Cocorote. Guárico: Chaguaramas. Lara: El Tocuyo.

This rust is abundant under conditions of excessive aridity.

12. *Uredo artocarpi* B. and Br. On *Artocarpus integrifolia* L. (arbol de pan).
    Arágua: Turmero.
13. *Transchelia punctata* Arth. On *Prunus persica* (L.) Stokes. (durazno).
    Arágua: Maracay.

USTILAGINALES

1. *Sphaerotheca sorghi* (Lk.) Clinton. On *Holcus sorghum* L. (millo). Arágua: Maracay. Sucre: Cumaná. Lara: Barquisimeto.
2. *Ustilago zeae* (Beckm.) Unger. On *Zea mays* L. Carabobo: Valencia. Arágua: Maracay. Sucre: Carúpano.
   This smut is rarely seen.
3. *Graphiola phoenicis* (Moug) Poit. On *Phoenix dactylifera* L.

HYMENOMYCETES

1. *Septobasidium pseudopedicellatum* Burt. On *Citrus sinensis* P.—On *Citrus maxima* (Burm.) Merrill.
   Arágua: Maracay.
2. *Corticium koleroga* (Cke.) v. Hoeh. (*Pellicularia koleroga* Cke.). On *Coffea arabica* L. (café).
   Arágua: Turmero.
3. *Daedalea elegans* Spring. ex Fr. (*Daedalea repanda*).
   Arágua: Rancho Grande.
4. *Fomes australis* (Fr.) Cke. Arágua: Rancho Grande.
   A tropical form of *Fomes applanatus*.
5. *Fomes marmoratus* (B. and C.) Cke. Guárico: Chaguaramas.
6. *Ganoderma sessile* Murrill. Arágua: Rancho Grande.
7. *Hexagona tenuis* Hook. ex Fr. Arágua: Rancho Grande.
8. *Lentinus crinitus* L. ex Fr. Sucre: Carúpano.
9. *Lenzites striata* Sev. ex Fr. Arágua: Rancho Grande.
10. *Omphalia flàvida* (Cke.) Maubl. and Rangel. On *Coffea arabica* L. Carabobo: El Trompillo, collected by Dr. A. Ciccarone.

At La Cumbre, on the road from Maracay to Ocumare de la Costa, specimens on an orchid, possessing both the *Stilbella flavida* stage and the carpophores were collected.

11. *Panus rudis* Fr. (*Lentinus stigosus*).—Sucre: Carúpano.
12. *Pleurotus sapidus* Kalchbr.—Carabobo: Valencia.
13. *Polyporus conchoides* (Mont.) Lloyd.—Arágua: Rancho Grande.
    Unusually large, snow-white pilei, growing on a log.
14. *Polyporus occidentalis* Klotzsch.—Arágua: Rancho Grande. Sucre: Cumanacoa.
15. *Polyporus sanguineus* L. ex Fr.—Sucre: Carúpano. Barinas: In Bocono River valley.
16. *Polyporus supinus* Schw. ex Fr.—Arágua: Rancho Grande.
17. *Schizophyllum fasciatum* Pat.—Sucre: Cumanacoa. Arágua: La Villa de Cura.
18. *Trametes corrugata* (Pers.) Bres.—Arágua: Rancho Grande.
19. *Trametes hydnoides* Schw. ex Fr.—Guárico: Chaguaramas. Sucre: Cariaco. Arágua: Rancho Grande.

The upper surface of the pilei is densely covered with a deep layer of trichomes, aggregated in such manner as to appear toothlike. This species is manifestly xerophytic.

20. *Cyathus montagnei* Tul.—Guárico: San Juan de los Morros.

FUNGI IMPERFECTI

1. *Asperisporium caricae* (Speg.) Maubl.—On *Carica papaya* L. (lechosa).
   Arágua: Boca del Rio. Carabobo: Valencia, Bejuma. Lara: Barquisemeto, El Tocuyo. Miranda: Cua. Sucre: Cumaná.

This widely prevalent pathogen presents the gross appearance of a rust and hence is known by many as *Pucciniopsis caricae* Earle. However, Maublanc (1913) established that it is connected with the perfect stage *Sphaerella caricae*.

2. *Cerebella andropogoni* Ces. On *Tricholaena* rosea Nees.
   Arágua: Maracay, El Limon.
3. *Cercospera atricincta* H. and W. On *Zinnia elegans* Jacq. (cuarentona).
   Arágua: Turmero. Dist. Federal: Caracas. Yaracuy: San Felipe. Sucre: Cumanacoa, Mariguitar.
4. *Cercospora beticola* Sacc. On *Beta vulgaris* L. (remolacha).
   Arágua: San Mateo. Lara: Barquisimeto.
5. *Cercospora bixae* Allesch. and Noack. On *Bixa orellana* L. (onoto).
   Arágua: Cágua.
6. *Cercospora brachiata* Ell. and Ev. On *Amaranthus spinosus* L. (pira brava).
7. *Cercospora brasiliencis* A. Sacca. On *Dioscorea alata* L. (ñame commún).
   Arágua: Turmero. Sucre: Cumanacoa.
8. *Cercospora caltropidis* Ell. and Ev. On *Caltropis procera* R. Br. (algodon de seda).
   Arágua: Cágua, Maracay. Dist. Federal: Caracas. Sucre: Carúpano.
9. *Cercospora cajani* Henn. On *Cajanus indicus* Spreng. (quinchoncho).
   Arágua: Maracay. Sucre: Cumaná.
10. *Cercospora chrysanthemi* H. and W. On *Chrysanthemum leucanthemum* L. (margarita).
    Dist. Federal: Caracas.
11. *Cercospora clavata* (Gerard) Cke. (*C. venturioides* Pk.). On *Asclepias curassavica* L.
12. *Cercospora coffeicola* B. and C. On *Coffea arabica* L. (café).
    Arágua: Turmero.
13. *Cercospora cruenta* Sacc. (*Mycosphaerella cruenta* Latham.) On *Vigna sinensis* (L.) Endl. (frijol).
    Arágua: Maracay. Sucre: Cumaná. Yaracuy: San Felipe.
14. *Cercospora demetrionina* Wint. On *Crotolaria spectabilis* Roth.
    Arágua: Maracay.
15. *Cladosporium fulvum* Cke. On *Lycopersicum esculentum* Mill. (tomate).
    Arágua: Maracay. Sucre: Mariguitar, Carúpano.

This fungus occurs on field-grown plants in Venezuela and other tropical areas, whereas it is best known on greenhouse-grown tomatoes in the United States.

16. *Cercospora henningsii* Allescher. On *Manihot esculenta* Cranz. (yuca).
    Arágua: Boco del Rio, Turmero. Sucre: Carúpano, Cumaná, Cumanacoa.

17. *Cercospora hibisci* Tracy and Earle. On *Hibiscus esculentus* L. (quimbombo).
    Sucre: Cariaco, Carúpano, Cumaná.
18. *Cercospora lantanae* Farl. On *Lantana camara* L. (cariaquito colorado).
    Arágua: Las Palomas, La Victoria. Yaracuy: San Felipe.
19. *Cercospora musae* Zimm. (*Mycosphaerella musicola* Leach). On *musa cavendishii* Lambert, *M. paradisiaca* L., and *M. sapientum* L. (cambur, platano, banano).
    Arágua: Maracay, Turmero, Cágua, La Villa de Cura. Miranda: Los Teques, Cua. Yaracuy: Urachiche, San Felipe. Lara: Anzoátegui, El Tocuyo. Sucre: Santa Maria, Casanáy, Carúpano, Cumanacoa. Monagras: San Antonio de Maturín, San Francisco.
20. *Cercospora nicotianae* Ell. and Ev. On *Nicotiana tabacum* L.
    Arágua: Turmero, Cágua, La Villa de Cura. Carabobo: Miranda, Montalban, Salóm. Sucre: Coccojár, Santa Maria. Monagras: Antonio de Maturín, San Francisco.

This organism is commonly present on seedlings; especially of the Burley type.

21. *Cercospora oryzae* Miyake. On *Oryza sativa* L. (arroz).
    Arágua: Maracay. Palo Negro, Santa Cruz.
22. *Cercospora personata* (B. and C.) Ell. and Ev. (*Mycosphaerella personata* Jenkins). On *Arachis hypogaea* L. (mani).
    Arágua: Maracay.
23. *Cercospora ricinella* Sacc. and Berl. On *Ricinus communis* L. (ricino).
    Arágua: Maracay. Sucre: Cumaná, Carúpano.
24. *Cercospora sesami* Zimm. On *Sesamum indicum* L. (ajonjoli).
    Arágua: Maracay.
25. *Colletotrichum coffeanum* Noack. On *Coffea arabica* L. (café).
    Arágua: Turmero.
26. *Colletotrichum gossypii* Southw. var. *cephalosporoides* Costa and Fraga. On *Gossypium hirsutum* L. (algodon).

Costa and Fraga (1939) ascribed excessive budding and branching of cotton in Brazil to a new variety of the well-known cotton anthrocnose fungus.

27. *Colletotrichum gloesporoides* Penz. On *Citrus sinensis* P. (naranja).
    Arágua: Maracay.
28. *Colletotrichum nigrum* Ell. and Hals. On *Capsicum annum* L. (ají dulce).
    Arágua: Cágua, Palo Negro, Maracay.
29. *Chaetodiplodia grisea* Petch (*Diplodia theobromae* Pat.).
    On *Theobroma cacao* L. (cacao).—Arágua: Maracay.
30. *Darluca filum* (biv.) Cast. On *Puccinia sorghi* Schw. and on *P. purpurea* Cke.

This hyperparasite of rusts is well-known to all mycologists.

Spegazzini (1908, vide p. 22) found it to possess a perithecial stage, which he described as *Eudarluca austrailis*. The ascospores are 3-celled, whereas those of my specimens are 2-celled. They may be immature, however.

31. *Helminthosporium ravenelii* Curtis. On *Sporobolus indicus* (L.) R. Br. (paja de gallina).
    Sucre: Las Piedras de Sabana, Santa Cruz. Dist. Federal: Caracas.
32. *Macrophomina phaseoli* (Maub.) Ashby. On *Nicotiana tabacum* L.
    Arágua: San Sebastian, Turmero. Sucre: Carúpano, Guanaguana. Monagras: San Antonio de Maturín. Anzoátegui: Guanape.
    On *Solanum melongena* L. (berengena).—Sucre: Cumana.
    On *Glycine max* Merr.—On *Phaseolus vulgaris* L. (caraota).—On *Vigua sinensis* (L.) Endl. (frijol).—On *Gossypium hirsutum* L. (algodon).
33. *Melanconium sacchari* (Ell. and Ev.) Massee. On *Saccharum officinarum* L. (caña de azucar).
    Arágua: Maracay. Sucre: Cumaná. Yaracuy: San Felipe.
34. *Monilia sitophila* (Mont.) Sacc. On *Gossypium hirsutum* L. (algodon).

Occurs in openings made by red boll-worm, *Sacadodes gossypii*, on cotton bolls, in fields near Maracay. Also copiously present on stubbles after a brush fire near Guanare in the State of Portuguesa. In the tropics this fungus is known to produce a pink coating on the refuse left after fires.

35. *Nigrosposa oryzae* (B. and Br.) Petch. On *Zea mays* L. stems.
    Arágua: San Sebastian.
36. *Phyllosticta eriobotryae* Thm. On *Eriobotrya japonica* Lindl.
    Dist. Federal: Caracas.
37. *Phomopsis citri* Fawcett (*Diaporthe citri* [Fawc.] Wolf). On *Citrus maxima* (Burm.) Merr.—Arágua: Maracay.
38. *Phomopsis vexans* (Sacc. and Syd.) Harter. On *Solanum melongena* L. (berengena).
    Arágua: La Victoria. Dist. Federal: Caracas.
39. *Piricularia grisea* (Cke.) Sacc. On *Digitaria sanguinalis* (L.) Scop.
    Guárico: San Juan de los Morros. Arágua: Maracay.
40. *Rhizoctonia solani* Kuhn. (*Corticum vagum* B. and *C.* var. *solani* Burt.)
    On *Nicotiana tabacum* L.—On *Brassica oleracea* L.
    Arágua: La Victoria.

This organism is widespread on tobacco, and becomes a very serious cause of damping-off of seedlings.

41. *Sphaceloma fawcettii* Jenkins (*Elsinoe fawcettii* Bit. and Jenk.).
    On *Citrus sinensis* P. and *C. nobilis* Laur.

Scab is commonly present on rough lemon and tangerine at Maracay.

SUMMARY

This is an account of a collection of 103 species of fungi, mostly plant pathogens, from Venezuela together with observations on their incidence. The list includes 14 Phycomycetes, 12 Ascomycetes, 3 Ustilaginales, 13 Uredinales, 20 Hymenomycetes, and 41 Fungi Imperfecti.

Diseases of crops are usually destructive in Venezuela. Weather predisposes the crops to certain diseases. Some pathogenic fungi are favored by the "dry season," and others by the "rainy season." Certain pathogens produce epiphytotics in Venezuela whereas the same species are of minor importance in the southeastern United States.

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Recent Systems of Polypore Classification

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Since 1941, three new systems of polypore classification were published. They appeared in the following works: Pilát, Polyporaceae, in Vol. 3 of the "Atlas des Champignons de l'Europe," 1936–1942; Imazeki, Genera of Polyporaceae of Nippon, 1943; and G. H. Cunningham, Polyporaceae of New Zealand, 1946–1948.

Pilát's work (24), originally issued in 48 fascicles between 1936 and 1942, can now be obtained from the author in two bound volumes, the first containing the text, written in French, the second containing 374 plates and nearly twice as many photographs of most of the species considered in the text, printed on coated paper. Combined with the text are keys to the genera and species and fairly complete lists of synonyms of the genera and species treated. Unfortunately, in the bound volumes, the dates of publication of the several fascicles are not included so that the actual date of publication of a genus or species cannot be readily ascertained if the first place of publication is in this volume. Through the kindness of J. A. Stevenson the fascicles with their pages, plates and dates are listed in the bibliography appended to this paper. New genera and species, published for the first time in this work, are not accompanied by Latin diagnoses. These names are technically *nomina nuda*.

Proof-reading has been careless and errors in understanding the author's meaning are easy to make unless the text is read with this in mind. Errors in citations occur and should be watched for carefully. Despite these defects, Pilát's work is the best reference available to students of this family. Workers in North America will not find it complete for that area since it overlaps only to the extent of including reference to North American material, which was supplied by Overholts and other workers, only when a species, or its close relative or relatives, is found in Europe. The lists of references to species in the extensive synonymies are exceedingly useful, although occasionally incomplete. This is especially true in the case of species which are widely distributed. In the case of these species workers in each area have treated them sometimes without knowledge of similar treatments in other areas. As is apparent in the current works of Lowe (19, 20) and Baxter (1), and in the later writings of Overholts (21, 22, 23), these workers do not always agree with Pilát's disposition of a species. Wider and narrower interpretation of generic and specific limits will always provide such disagreements. In such cases, cross references such as Pilát gives are always helpful to other workers.

The genera are arranged in a modified Patouillardian system without reference to subfamilies within the true *Polyporaceae*. In his key to the *Polyporales* the first division separates the *Fistulinaceae* from the

Polyporaceae, the only families assigned to this order. The *Boletaceae* are not mentioned. In this key the family *Polyporaceae* is divided into the subfamilies *Polyporoideae*, *Ganodermoideae* and *Hymenochaetoideae*, and these subfamilies are not mentioned again. Lists of generic synonymy are as complete as one could wish, for legitimate generic names, but the skeleton system published in 1941 by Bondarzew and Singer (2) is not mentioned.

Several surprises are in store for the student of this family who is more familiar with the conservative treatment of Overholts so long in use in North America, and there are few similarities between the systems of Pilát and Murrill. In *Grifolia*, for instance, are included both rough-spored species (included by others in *Boletopsis* and *Bondarzewia*), and smooth-spored species. As a section of this genus, Murrill's *Laetiporus* is included to take care of *Polyporus sulphureus*, a position different from that usually accorded this species.

Gloeoporus, included by some in a separate group of fungi with *Merulius*, *Phlebia*, *Coniophora*, etc., is divided into two subgenera. In one are placed species like *Gloeoporus dichrous;* in the other, *Bjerkandera*, species like *Polyporus adustus*.

Trametes includes all light-colored annual polypores with trametoid context. This produces a large, peculiar assemblage of species placed by others in such genera as *Trametes*, *Coriolus*, *Lenzites*, *Irpex*, *Pogonomyces* and others.

The perennial species are divided into light- and dark-context groups. Of the three genera in the white-context group, *Truncospora* Pilát is erected for two closely related species, one of them *Fomes ohiensis*, a fungus familiar to collectors in eastern United States.

Poria is divided into 8 subgenera following the treatment of Bourdot & Galzin (3). Of these, four are partly or wholly combined with pileate genera; this action includes species included in *Poria* by Overholts (23), Lowe (20), and Baxter (1). The key to *Poria* covers 11 pages and uses 97 dichotomies. Some of the 8 subgenera are further divided by Pilát on the basis of presence or absence of cystidia and shape of spores (ellipsoid, cylindric or globose).

Species of polypores with brown context, *Hymenochaetoideae*, whether resupinate or pileate, annual or perennial, are divided into three genera. Those usually perennial, placed by many workers in *Fomes* Kickx, and by Murrill in *Pyropolyporus*, *Porodaedalea*, etc., are placed in *Phellinus*. Those species which are annual, pileate or resupinate and with colored spores are referred to *Inonotus*, while those which are dimidiate to centrally stipitate, with or without setae and with hyaline spores go into *Polystictus* Fr. em. Ames. The use of this generic name seems to the writer unfortunate, but, since Pilát does not recognize S. F. Gray as post-Friesian, no other choice could have been made. Those who recognize S. F. Gray as post-Friesian, as demonstrated by Rogers (25), use the name *Coltricia* S. F. Gray for this group, or the largest part of it. An interesting point in this connection is that in his discussion of *Polystictus perennis* Pilát lists 54 combinations of 24 specific names of which 5 are later considered as forms of the species. Most of the species of Coltricia listed in Coker's (4) recent paper are to

be found under this synonymy and under these forms. Two subgenera of *Polystictus* are used of which the second is *Onnia*, a Karsten genus originally of wider application, in which is placed *Polyporus tomentosus*, with three forms.

Illustrations are given in the text in connection with each genus showing spore shape, size, and sculpturing, when present. A total of 275 text figures, mostly illustrating spores, are used to compare important features of these fungi.

One of the most extensive bibliographies and synonymies is that given in connection with *Ganoderma applanatum* in the *Elfvingia* (Karst.) Imazeki subgenus of *Ganoderma*. This covers two pages of text, cites 66 combinations of 37 specific names and 140 references to systematic works in which it is treated. *Ganoderma* and *Amauroderma* are the only genera included in the *Ganodermoideae*.

Certain inaccuracies in citation should be noted. Under *Ganoderma lucidum* Pilát recognizes "subspecies *typicum* Maire (pro var.)." This, of course, should be *Ganoderma lucidum* ssp. *typicum* (Maire) Pilát, as a new combination. Wherever new subspecific entities are described or discussed this type of citation should be carefully checked by those interested in completing their synonymy files.

Pilát's treatment of some of the commoner species is interesting. Rather than relegate to complete synonymy a number of names applied to more or less superficial dissimilarities, he has erected one or more forms, subspecies or varieties. He apparently uses these terms indiscriminantly for the same general concept—an infraspecific category. For instance, to select one of the more elaborate species treatments, take the case of the fungus commonly called *Polyporus abietinus* in North American treatments. This is a very common slash rot of coniferous wood placed by some in *Polystictus*, by Murrill and others in *Coriolus*, by Donk in *Hirschioporus*, etc.. Pilát chooses to place this species in *Trametes*, probably as a new combination. Under this species he recognizes the following infraspecific categories:

f. *caesio-alba* (Karst.) Bourd & Galz., for a thin, light form;
var. *fusco-violacea* (Ehr.) Pilát (as a new combination), for a violet or purple irpiciform form;
var. *Irpex-tabacinus* (Berk. & Curt.) Pilát (as a new combination), for a usually resupinate, less irpiciform form of var. *fusco-violaceus;*
var. *Sistrotrema-hollis* (Sch.) Bourd. & Galz., for a rare, gelatinous, hydnoid form;
var. *Xylodon-candidum* (Ehr.) Bourd. & Galz., for a pale, hydnoid form;
f. *abietis* (Lloyd) Overholts, for a lenzitoid form.

The last cited form is illustrative of Pilát's sometimes inaccurate citations, for Overholts made this combination as a variety, not as a form.

At least var. *fusco-violacea* and f. *abietis* are recognizable in series of North American collections.

Rokuya Imazeki, in Japan, has been an energetic worker in the Polyporaceae for a number of years. He has worked largely with species in Japan, on the neighboring islands, and on the mainland of Asia.

He has published on pileate species of Thelephoraceae and other Basidiomycetes, as well.

In 1943 he published in Tokyo (18), a system of the Polyporaceae of Nippon in which he recognized 38 genera in 4 tribes and 7 subtribes. While the discussion is in Japanese, the synonymy is in English and the generic diagnoses are in Latin. The reviewer does not read Japanese and so cannot give an appreciation of Imazeki's discussion of more than 100 genera of the family upon which he bases his selection of the genera which are discussed in the systematic treatment.

The four tribes recognized include: *Polyporeae*, *Ganodermeae*, *Mucronoporeae* and *Cryptoporeae;* the influence of Donk can be noted in this arrangement. The *Cryptoporeae* includes only *Cryptoporus volvatus* which, indeed, is a unique species, but which has never occupied such an isolated position in earlier treatments.

The tribe *Ganodermeae* includes the three genera *Amauroderma*, of tropical distribution, and *Ganoderma* and *Elfvingia* which occur in temperate as well as tropical regions. Segregation of *Ganoderma applanatum*, *G. lobatum*, etc., in *Elfvingia*, from *G. lucidum*, etc., in *Ganoderma*, is not unusual in treatments using small genera although all are included in *Fomes* in the more conservative treatments. Based on spore characters, however, this seems to be a good method of treating these fungi. From a citation used above it will be noted that Imazeki has gone beyond an earlier concept of the genus *Ganoderma* in which *Elfvingia* was merely treated as a subgenus.

The remaining genera are segregated regardless of whether they are pileate or resupinate, annual or perennial, into those with light context, the *Polyporeae*, and those with dark context, usually with setae, the *Mucronoporeae*, a name based on Ellis's unused genus *Mucronoporus*, which was erected for a very heterogeneous assemblage of species.

Eight genera are placed in the *Mucronoporeae*, the porose genera of Donk's *Hymenochaetoideae;* Pilát also referred this group to the *Hymenochaetoideae*. *Hydnochaete* includes the strongly irpiciform species; *Cyclomyces*, in the sense of Murrill, includes species on woody substrata with tubes arranged concentrically; *Phellinus* is emended so as to exclude certain species like *Fomes pini*, *F. ribis* and a number of Japanese and Asiatic species for which the new genus *Cryptoderma* Imazeki was erected based on *F. ribis*. *Inonotus* and *Phaeolus* are used much as Murrill used them, while *Onnia* includes *Polyporus tomentosus* and *Coltricia* includes the centrally stipitate brown species as Murrill, Coker and others have used it with the exception that *Cyclomyces greenei*, strangely enough, is included in it.

The tribe *Polyporeae* is divided into seven subtribes. In studying Imazeki's disposition of genera in these subtribes it is not always easy to see on what characters his ideas are based, since, as stated above, the writer does not read Japanese. Certainly, his concepts are entirely different from those of Pilát, neither do they follow completely those of Donk, nor those of Bondarzew and Singer, from whom, to a certain extent, he has drawn his generic concepts.

In the *Trametinae* are placed *Trametes*, *Lenzites*, *Gloeophyllum*,

Daedalea, *Hexagona* and *Daedaleopsis*. With the exception of *Daedalea*, which is used in the otherwise unaccepted Friesian sense for *Polyporus biennis*, and *Hexagona*, these genera are all placed in *Trametes* by Pilát. Pilát follows Donk in placing *Polyporus biennis* in the genus *Heteroporus* Lazaro em. Donk. The present writer feels that *Daedalea* should be used in the sense of *D. quercina*, rather than in the sense of *Polyporus biennis*, the first species included in the genus by Fries, placed in *Abortiporus* by Murrill and now referred to *Heteroporus* by Donk and others.

The *Coriolinae* of Imazeki contain *Irpex*, *Coriolus*, *Oxyporus*, *Hirschioporus* and *Antrodia*, another generic sequence placed in synonymy with *Trametes* by Pilát except for the perennial *Oxyporus* (*Fomes connatus*) which is grouped with the white-context *Fomes* segregates.

The *Tyromycetinae* include a peculiar assemblage consisting of *Tyromyces*, *Hapalopilus*, *Bjerkandera*, *Gloeoporus* and *Laetiporus*. The writer fails to see how five such different genera can be grouped in the same subtribe, suggesting close relationship.

Again, in the *Piptoporinae*, *Ischnoderma*, *Porodisculus* and *Piptoporus* certainly do not seem to be related. If the reasons for his classification of these two subtribes are given, they are lost in Japanese characters.

The segregation of the light-context species of *Fomes* in the *Fomitinae* into *Fomitopsis* and *Fomes* follows Bondarzew and Singer.

The *Favolinae* include *Favolus* and *Microporus*, certainly two extremes in pore size superficially; however, Miss Ames's emendation of *Favolus* includes *Polyporus picipes* and related species.

The large, central-stemmed polypores are put together in the *Polyporinae*. *Polyporus*, for single-stemmed, smooth-spored species; *Bondarzewia* for rough-spored species; and *Grifola* for multiple-stemmed species are included here. It should be noted that *Laetoporus* (*Polyporus sulphureus*) is placed in a different subtribe, the *Tyromycetinae*, in contrast with the treatment by Pilát, who makes it a subgenus under *Grifola*.

The work is, in part at least, an artificial assemblage of genera. Lacking a translation, we cannot say to what extent this apparent artificiality is caused by a lack of knowledge of the author's viewpoint concerning his reasons for the generic limits he has chosen.

As is well known, G. H. Cunningham, in New Zealand, has long been interested in the Basidiomycetes of that country and published voluminously upon them. His latest contribution is a treatment of the polypores. The basis for this treatment is one never before used in basidiomycete systematics, that of the microscopic anatomy of the pileus. As Cunningham applies this series of characters (7), the treatment appears artificial for he does not seem to consider other characters to be of as much value. Many workers may reject this treatment because it completely ignores spore color, spore-wall marking, hymenial elements other than the basidium, gross structure, and other elements used by other workers in the group. It is interesting to note that the genera he has chosen, as a result of his interpretation of this new emphasis, are small in number—11—with relatively large species

aggregations; about 100 species are treated. While he does not include keys to the genera he uses, he does include keys to the species within each genus. The genera chosen are familiar in name, no new ones having been erected, and the species aggregations are those one would expect to find in conservative treatments of the genera used.

The basis of Cunningham's anatomical characteristics can be found in two papers by E. J. H. Corner (5, 6) on the anatomy of *Polyporus xanthopus*, a common centrally stemmed species growing on woody litter in the tropics and referred by some to *Microporus*, and on a tropical *Fomes*. In these species Corner found three important types of hyphae making up the structure of the pileus. The generative hyphae terminate in the basidia and certain hyaline elements of the hymenium; they may or may not be septate and may or may not have clamp connections. The most important hyphae of the pileus are the skeletal hyphae which form, as their name suggests, a skeleton in which the binding hyphae and the generative hyphae are arranged. When only generative hyphae are present the hyphal system is called monomitic; when generative and skeletal hyphae are present the hyphal system is called dimitic and when all three types (skeletal, binding and generative) are present the system is trimitic. The skeletal hyphae were found by Cunningham to be of two subtypes: "bovista hyphae" which resemble the capillitium of the puffball *Bovista*, and "long-type" hyphae which are elongate, slender hyphae with or without septa.

Cunningham recognizes three types of basidia in the Polyporaceae. Merulioid basidia are hyaline, long, cylindric, 12–30 x 3–4 μ, persistent, and occur in a firm gelatinous layer. Genera with this type include *Merulius sensu lato*, not treated in this work, and *Gloeoporus*, combined with *Polyporus*. The second type of basidium is "honey-comb." These are hyaline, clavate, oval, short, 8 x 4 μ, firmly cemented at the base into a palisade. When the basidia collapse they leave their cemented bases which give a honey-comb appearance when viewed in longitudinal sections of tubes. Most of the brown-context species of polypores and at least three species of *Fomes* have this basidial type. The third type is called "clavate." Most of the species of polypores have this type. They are clavate, elongate-clavate to fusoid, 6–25 μ long, compacted or loosely arranged, collapse to form a mucilaginous layer on the trama wall after spore discharge.

Cunningham recognizes the following types of hymenial or tramal inclusions: setae, cystidia, gloeocystidia, lactiferous ducts, crystals and mucilage. However, he feels that they are of doubtful systematic importance.

In a few species Cunningham reported the number of nuclei in the hyphal cells. Wherever clamp connections are present and nuclei were observed in all three types of hyphal systems, the cells were binucleate. In some species with dimitic hyphal systems where no clamp connections were observed, the cells were uninucleate.

Cunningham quotes Corner's statement regarding the difficulties encountered in the identification of species in the pore fungi using current literature in which diagnoses are incomplete at best. It is suggested that microscopic characters, such as those of the anatomy of

the fruit body and the morphology of the hymenium will be of greater aid to the mycologist than the macroscopic characters more commonly used. In describing the New Zealand species with these points in mind he gives as elaborate descriptions as those used in recent papers by Lowe (19, 20) and Baxter (1) in the United States. Since emphasis is put on hyphal systems and hyphal types, these points are elaborated more than they are by Lowe or Baxter. Such information would also be of use if given for all valid species of polypores.

Cunningham presents only a bare outline of his system. The primary key characters in the larger genera are based on the hyphal systems; some of the ultimate key characters are supplemented by basidial type characters. In this respect his work is somewhat disappointing, since one is led to believe that anatomical characters will receive the greatest emphasis. According to a recent letter from Dr. Cunningham, the New Zealand treatment is preliminary to a general treatment for some 350 species from New Zealand, Australia and Tasmania. This forthcoming work will be based on anatomical studies of type material and other specimens and a larger number of genera will be recognized in it. It is bound to be of great interest to students of the higher fungi.

In the New Zealand work three tribes are recognized. In the *Poriae* we find the light colored species in the genus *Poria* (Pers.) S. F. Gray em. Cunningham (8). Fourteen synonyms are listed. The brown species of *Poria*, included by Pilát in *Phellinus*, are here placed in *Fuscoporia* Murrill (9) with 7 synonyms.

Three genera are recognized in the *Polyporeae*. The first of these is *Polyporus* Mich. ex Fr. with 47 synonyms (10). *Coriolus* Quel. with 4 synonyms (11) is included here as is *Fomitopsis* Karst. (12) with no synonyms.

The *Fomiteae* comprise three genera. *Coltricia* S. F. Gray (13) includes 10 synonyms, and in this genus are placed such diverse genera as *Phaeolus* (*Polyporus schweinitzii*), *Microporus*, *Romellia*, etc. *Inonotus* Karst. (14) is included here with little change and accompanied by 7 synonyms. *Fomes* Kickx with 9 synonyms (15) is defined in such a sense as to include *Ganoderma*, *Phellinus*, *Elfvingia* and *Pyropolyporus*.

Three genera are added without definite assignment to either of the three tribes mentioned above. These are *Lenzites*, *Tramates* and *Daedalea* (16). *Daedalea* is used in a sense to include *Gloeophyllum* and *Daedaleopsis*. *Gloeophyllum* is usually used as a synonym or segregate of *Lenzites*.

Of these three systems of classification none is completely acceptable to the writer. Cunningham's treatment is still too conservative, as it ignores certain characters in setting up the major divisions although intended to simplify the classification of the group. Imazeki's system presents an arrangement which appears to be inconsistent. However, these criticisms may prove unjust if the work were translated. Pilát's system is the most useful recent treatment because of the large amount of information presented concerning each species treated; but it presents some workers with problems of interpretation, especially

in generic limits, valid generic names, and the lumping of certain generic and specific groups, whereas others will find in it a solution to many of these problems. None of these systems is completely applicable in its present form to an area outside of the region for which it is intended.

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Florida Clitocybes

(Clitocybe, Monadelphus, Laccaria)

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These are fleshy gill-fungi with hyaline spores and decurrent or adnate gills. Many occur on humus in woods, others on dead wood. Very few are poisonous. The species known to occur in this country were treated by me in the ninth volume of North American Flora, pages 396–421, and the tenth volume of the same work, pages 1–3. Since 1916 many new species have been described.

KEY TO GENERA

Spores not distinctly rough.
  Hymenophore not cespitose and usually not wood-loving........1. Clitocybe
  Hymenophore cespitose and wood-loving....................2. Monadelphus
Spores distinctly rough, globose..................................3. Laccaria

1. CLITOCYBE (Fr.) Quél.

Pileus fleshy; lamellae decurrent, or adnate; spores hyaline; stipe central, fleshy; veil none.

Pileus black, 1 cm. broad; stipe white.............................*C. concaviformis*
Pileus latericious, 5–8 cm. broad; stipe white........................*C. Rappiana*
Pileus luteous, 8 cm. broad; stipe luteous...........................*C. luteiceps*
Pileus reddish or pale-tan, 4–7 cm. broad; stipe concolorous,
  5–7 × 0.6–1 cm..*C. infundibuliformis*
Pileus rosy-avellaneous, 3 cm. broad; stipe white, clavate,
  4 × 0.6–0.8 cm...*C. Westii*
Pileus rosy-isabelline, 4–5 cm. broad; stipe white, 4 × 0.4 cm......*C. subpinophila*
Pileus avellaneous.
  Pileus 1.5–2.5 cm. broad; stipe 1.5–2 cm. long.....................*C. praticola*
  Pileus 4.5–6 cm. broad.
    Lamellae crowded...*C. alachuana*
    Lamellae distant...*C. submedia*
Pileus dark-isabelline, cespitose; stipe white........................*C. australis*
Pileus white or pale-tan, 2.5–5 cm.; stipe concolorous,
  4–7 × 0.2–0.4 cm...*C. adirondackensis*
Pileus pallid to subavellaneous; stipe dull-avellaneous...............*C. azalearum*
Pileus uniformly white, unchanging, 1.5–3 cm. broad; growing
  on dead hardwood.
  Lamellae distant...*C. peralbida*
  Lamellae crowded.
    Stipe eccentric, 1–2 mm. thick............................*C. subeccentrica*
    Stipe central, 2–4 mm. thick..............................*C. subtruncicola*
Pileus white or pallid; growing on the ground.
  Lamellae white; stipe white..................................*C. praefellea*
  Lamellae violet; stipe violet..............................*C. cortinarioides*

ANNOTATED LIST OF FLORIDA SPECIES

C. adirondackensis (Pk.) Sacc. See N. Am. Fl. **9**: 401. 1916.—Described from N. Y. and found in woods southward to Fla. Common about Gainesville in high hammocks and also collected in Columbia and Marion Counties.

C. alachuana Murr. Proc. Fla. Acad. Sci. **7**: 107. 1944.—Described from Gainesville, on leaf-mold in a low hammock. Rare in the vicinity.

C. australis Murr. Lloydia **7:** 303. 1944.—Described from Gainesville, in thin frondose woods.

C. azalearum Murr. Lloydia **5:** 137. 1942.—Described from Gainesville, on leaf-mold in an azalea bed.

C. concaviformis Murr. Proc. Fla. Acad. Sci. **7:** 107. 1944.—Described from northwest of Gainesville, on an oak log in a hammock.

C. cortinarioides Murr. Lloydia **9:** 315. 1946.—Described from Gainesville, in a live-oak hammock.

C. infundibuliformis (Schaeff.) Quél. See N. Am. Fl. **9:** 408. 1916.—Described from Europe and found on leaf-mold in woods in temp. N. A., southward to Fla. and westward to Ia. and Col. Said to be rare about Gainesville. Bresadola found it in fir woods; Kauffman on decaying leaves in both acerose and frondose woods.

C. luteiceps Murr. Proc. Fla. Acad. Sci. **7:** 108. 1944.—Described from Gainesville, on leaf-mold under a laurel oak in a high hammock.

C. peralbida Murr. Mycol. **35:** 529. 1943.—Described from northwest of Gainesville, on dead hardwood in a hammock.

C. praticola Murr. Lloydia **5:** 136. 1942.—Described from Gainesville, on a lawn partly shaded by oaks and pines.

C. praefellea Murr. Lloydia **8:** 273. 1945.—Described from Gainesville, on an exposed lawn near a laurel oak.

C. Rappiana Murr. Proc. Fla. Acad. Sci. **7:** 108. 1944.—Described from west of Gainesville, on the ground in a high hammock.

C. subeccentrica Murr. Bull. Torr. **67:** 233. 1940.—Described from near Santa Fé, Alachua Co., on dead hardwood in beech woods.

C. submedia Murr. Proc. Fla. Acad. Sci. **7:** 108. 1944.—Described from northwest of Gainesville, on the ground in a hammock.

C. subpinophila Murr. Bull. Torr. **66:** 156. 1939.—Described from Gainesville, on the ground under frondose trees.

C. subtruncicola Murr. Bull. Torr. **66:** 157. 1939.—Described from northwest of Gainesville, on a rotten oak log in a hammock.

C. Westii Murr. Lloydia **7:** 303. 1944.—Described from northwest of Gainesville, on the ground in a hammock.

2. MONADELPHUS Earle

Pileus fleshy, densely cespitose and wood-loving; lamellae decurrent, rarely adnate; spores hyaline; stipe central or nearly so, fleshy or fleshy-tough; veil none.

Pileus white...*M. floridanus*
Pileus subfulvous, fibrillose.......................................*M. Watsonii*
Pileus usually melleous, disk squamulose............................*M. tabescens*
Pileus reddish...*M. subilludens*
Pileus umbrinous...*M. umbriniceps*

M. floridanus Murr. Lloydia **7:** 308. 1944.—Described from northwest of Gainesville, on dead oak in a hammock.

M. subilludens Murr. Jour. Fla. Acad. Sci. **8:** 180. 1945.—Described from Gainesville, on the base of a living *Phoenix canariensis*, and frequent in the county on oak, plum, palm, etc. Also collected in Volusia Co.

M. tabescens (Scop.) Murr. comb. nov. See N. Am. Fl. **9:** 420, under *M. caespitosus* (Berk.) Murr.—Described from Carniola and found in woods or open places from N. Y. and Kan. to Fla. and

Honduras. In Fla. it attacks the roots of a vast number of trees and shrubs, causing an immense amount of damage.

M. umbriniceps Murr. Jour. Fla. Acad. Sci. **8:** 181. 1945.—Described from Gainesville, on an open grassy lawn near laurel oaks, forming a large fairy ring. Not wood-loving, like the other species, unless from buried wood.

M. Watsonii Murr. Proc. Fla. Acad. Sci. **7:** 111. 1944.—Described from Gainesville, on the ground in a high hammock, probably attached to buried wood.

3. LACCARIA Berk. & Br.

Pileus fleshy, thin; lamellae broadly adnate, thick, whitened by the spores, which are globose, hyaline, and rough; stipe central, fleshy or fibrous; veil none.

Pileus 1–5 cm. broad.
    Lamellae violet.......................................*L. amethystea*
    Lamellae incarnate or pallid.
        Pileus 0.5–1 cm. broad, irregular.......................*L. tortilis*
        Pileus 1.2–5 cm. broad, regular.
            Pileus 2 cm. or less broad, striatulate..................*L. striatula*
            Pileus usually larger, even.........................*L. laccata*
Pileus 5–10 cm. broad.......................................*L. ochropurpurea*

L. amethystea (Bull.) Murr. N. Am. Fl. **10:** 1. 1914.—Described from France and found on shaded damp soil in eastern temp. N. A. Rare about Gainesville in hammocks.

L. laccata (Scop.) Berk. & Br. See N. Am. Fl. **10:** 2. 1914.—Described from Carniola. Abundant and cosmopolitan in shaded moist soil. Plentiful about Gainesville after rains at all seasons, especially in pine woods.

L. ochropurpurea (Berk.) Pk. See N. Am. Fl. **10:** 2. 1914.—Described from O. and found in thin woods in temp. N. A., southward to Fla. Rare about Gainesville in hammocks.

L. striatula Pk. See N. Am. Fl. **10:** 2. 1914.—Described from N. Y. and found in damp places in the eastern U. S. Frequent about Gainesville. Also in Union Co.

L. tortilis (Bolt.) Pat. See N. Am. Fl. **10:** 2. 1914.—Described from Eng. and found in damp places in the eastern U. S. Rare about Gainesville. Known by its large aculeate spores, 12–15 μ.

ADDED SPECIES

L. tetraspora Sing. Mycol. **38:** 689. 1946.—Described from Highlands Hammock, Fla., and reported also from Mass., N. Y., and Uruguay. I have not seen any of this material. Singer says I once called an Adirondack specimen *L. striatula* Pk.

TRANSPLANTING WILD MUSHROOMS

Very little has been done in this field, so far as I know, but it seems attractive and might add much to our ecological knowledge of various wild species, both edible and poisonous. One could study them daily at close range and make a meal *ad lib.* without a long walk in the woods.

In constructing a fernery, sandstone and limestone rocks are brought in, pockets filled with leaf-mold are provided, there is shade and sun, wet soil and dry soil, and a pool for those growing on water. The

same general plan would serve for mushrooms, the idea being to provide each species with a habitat similar to its natural home.

Lawn-loving Species

In New York City I had a large, grassy lawn partly shaded by oaks and maples. Several edible fungi were transplanted there simply by removing a square of sod and substituting one from a field or meadow containing the mycelium of a species I wanted. In this way *Clitocybe multiceps* became established and soon covered several square yards. Many a meal I had from its attractive clusters!

Pasture-loving Species

Droppings of dung from domestic animals provide the extra nitrogen necessary for several valuable edible species, including those we cultivate. In one corner of my yard I marked off a large square and spread cow manure over the grass, renewing it at intervals. Here I set out sods from a pasture containing *Agaricus campestris* and certain other edible species requiring similar food and living conditions. A hose provided water when needed. Growing in the open in this way, the fruit-bodies are less liable to attack by insects and molds.

Dung-loving Species

In another corner I had a pile of cow manure and one of horse manure. It is surprising how many fungi grow on unadulterated dung. *Coprinus fimetarius* is one of these. When picked young and fresh many of the species are delicious.

Woodland Species

Every home should have a wood lot. In the humus beneath the trees hundreds of wild mushrooms grow naturally. They need shade and a more acid soil than pasture-loving kinds. Some are found only beneath conifers; others must have what oaks, beeches and other hardwood trees provide. If one is fortunate enough to own a grove of pines and one of hardwoods, he can transplant many wild mushrooms to his groves and water them when needed. I made a bed under my large sugar maple, where over a dozen wild species grew in the humus and developed just as though they were in the forest. At Gainesville, Fla., I often pick a mess of *Boletus brevipes* under my loblolly pine in midwinter.

Wood-loving Species

In the Orient excellent mushrooms are grown on oak logs sprinkled with rice water. On Blackwell's Island, in New York, a physician grew *Pleurotus ostreatus* on poplar logs simply by keeping them wet. Old logs in woods usually harbor numerous species. If one wishes to transplant others he can easily cut out a section in a log and insert another containing mycelium. Care must be taken, however, to choose the same kind of log, at the same stage of decay and lying in the same amount of shade. Water should be used at first, just as in planting a tree. *Polyphorus sulphureus* is an excellent wood-loving species. In Florida, magnolia logs in woods are often found covered with beautiful clusters of the oyster mushroom, even in midwinter if the weather is mild and moist.

Some Experimental Studies on Citrus in Liberia, West Africa

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The genus *Citrus* is an interesting one, not only because of its economic importance but also because of the morphological diversity found in the fruit. It includes varieties either producing food or yielding perfume and others acceptable as ornamentals. The ability of *Citrus* varieties and species to interbreed freely, a striking feature of this genus, has been pointed out by a number of authors, among them Barrett (1), Webber (6), et al. Seed mutations and bud sports are also very common in this genus and many of our best known citrus fruits arose as naturally occurring mutations which were then selected by man as being particularly useful. In order to preserve these mutations in the selected form, they must be reproduced vegetatively. Grafting is generally agreed to be the most effective method, although cuttings have given a low percentage of rooting (1) (4). It seems improbable that like methods of propagation will prove equally effective in all parts of the world or that the same stocks prove best for all scions under different environmental conditions (1) (2) (3) (4) (6). Therefore the following discussion of some experimental results obtained in Liberia, West Africa, may be of some interest.

Citrus planting in Liberia is undergoing considerable expansion at the present time, and increased production of many citrus products may be envisaged in the not too distant future. Virtually no citrus improvement had been undertaken up to a few years ago, except for a single importation by the Firestone Plantations Company of a grapefruit and a tangerine variety, whose correct identification is not now available. However, in conjunction with a vastly expanded plant introduction program, over forty new *Citrus* varieties were imported in 1945-46, and many selections were made from promising local plants, such as the semi-wild sour orange of the vicinity, which occasionally produces sweet forms.

The writer at that time was in charge of a plant introduction program for the Firestone Plantations and in that connection made a trip along the West African Coast, to Nigeria, Gold Coast and the Ivory Coast in September, 1946, collecting seeds and budwood of useful plants. Among many importations of food and vegetable crops, the following *Citrus* species and varieties were introduced: orange varieties (*Citrus sinensis* [L.] Osbeck) Acné, Blood, Emperor of China, Golden Buckey, King, Laranja selecta, Mediterranean Sweet, Nigerian Navel, St. Michael, Shorney Seedless, Temple, Washington Naval; grapefruit varieties (*C. paradisi* Macf.) Duncan, Foster, McCarty, Marsh, Royal, Thompson, Walters; tangerine and mandarin varieties (*C. nobilis* Lour.) Algerian, Bingerville, Canton, Cleopatra, Dancy, Java, Ivory Coast mandarin and Gold Coast Tangerine; tangelo varieties (*C. nobilis* × *C. paradisi*) Ma 203, Ma 215, and Ma 224 (Gold Coast

selections); lemon varieties (*C. Limonia* Osbeck) Genoa and Bruto Gardo; the West Indian Lime (*C. aurantifolia* Swingle); the Chair Rose shaddock (*C. grandis* Osbeck), the citron (*C. medica* L.), the Satsuma orange (*C. nobilis* var. *unshiu* Swingle) and two kumquat varieties (*Fortunella* Swingle), Doux and Acide (from the Ivory Coast).

Imported from the United States Department of Agriculture in 1945 were the Pineapple, Rico #2 and Navel oranges, Eureka and Lisbon lemons, Marsh Seedless, Foster Pink and Triumph grapefruit and the Seedless Persian Lime. Specimens of all of these plants were successfully propagated and form a potentially valuable source of food and income, not only to the Firestone Plantations but also to the inhabitants of Liberia. For these reasons, the experiments here described have a definite application to future field practice.

EXPERIMENTS ON CITRUS CUTTINGS

On several occasions attempts were made to propagate various species by vegetative means. Marcotting was found to give fair results but not good enough to compete with budding or grafting as a method of propagation. Other treatments consisted of application of growth hormones in various concentrations and media. Cuttings were 12–14 inches long, each with 5–6 nodes, were planted immediately in sand and shaded with banana leaves for three days after planting. The first experiments consisted of the application of .0002% indole-3-acetic acid in hydrous lanolin to the basal 5 cms. of the cutting. A slight improvement may be ascribed to the treatment but the effect is too slight to be of much value.

Dipping cuttings in a strong solution of hormone was also tried. The bases of the cuttings were dipped in a 0.6% solution of indole-butyric acid or a 0.6% solution of indole-3-acetic acid and then planted immediately in sand. Immersing the bases of cuttings 24 hours in a .0002% solution of indole-butyric or indole-3-acetic acid was also tried.

Under Liberian conditions, rooting of cuttings with or without hormone treatment is unsatisfactory. On the basis of these results, it was decided to concentrate efforts on propagation by grafting.

CHARACTERISTICS OF A GOOD CITRUS STOCK

A good citrus stock should have the following characteristics: it should graft easily with all or most scions, it should be vigorous, it should stand transplanting well, be resistant to disease and adaptable to local environmental conditions. In addition, the adventitious buds should not grow too freely since such growth requires extensive pruning operations, which are both time consuming and expensive.

GERMINATION TRIALS

Nursery beds were planted with seed of rough lemon, *C. Limia* Osbeck, sour orange, *C. aurantium* L., common lime, *C. aurantifolia* L., grapefruit, *C. paradisi* Macf., and tangerine, *C. nobilis* Lour. Fresh seed from local trees was used in all plantings. Germination results were noted at the end of ten days and again at the end of a month. The results are shown in Table 1.

Rough lemon seeds germinated very rapidly and completely, whereas, sour orange and lime did fairly well. Grapefruit and tangerine

gave poor germination. At the end of a month, all beds were supplied with fresh seed. No further supplies were made.

BUDDABLE STOCK PRODUCED

Twelve months later the beds were again examined. The only treatment in the meantime had been a periodic clean weeding about once every three months. In general the young seedlings were all in a healthy condition with no unusual disease or insect damage, except that the rough lemon plants showed their customary chlorotic appearance. Poor growth of the tangerine and grapefruit seedlings was

TABLE 1. *Germination trials of various species of Citrus.*

Source of seed	10 day germination	30 day germination
Rough lemon	65%	90%
Sour orange	40%	80%
Common lime	40%	75%
Grapefruit	40%	60%
Tangerine	40%	60%

TABLE 2. *Percentage of buddable trees produced in beds of one-year-old seedling citrus.*

Source of Seed	Buddable seedlings
Rough lemon	75%
Sour orange	65%
Lime	60%
Tangerine	40%
Grapefruit	40%

readily observable. Rough lemon showed the most vigorous growth, despite its rather unhealthy appearance. Experiments in other tropical countries by Rolfs and Rolfs (4) and Vosburg (5) have shown the same results, i.e., an early rapid growth of rough lemon seedlings. In addition to greater diameter, the average height of the rough lemon seedlings was approximately 10% greater than any of the other seedlings. The percentage of buddable trees in each group is given in Table 2.

Rough lemon produced the highest percentage of buddable stocks (diameter approximately 12 mm. at a height of 6 cms.) while sour orange and lime gave somewhat poorer results. Tangerine and grapefruit made very unsatisfactory growth.

BUDDING METHOD

A brief description of the budding method may be in order here. The budder makes two longitudinal incisions in the stem of the seedling tree or stock, beginning about 2.5 cms. from the base and cutting upward about 4 cms., the second incision about 2–2.5 cms. from the first. Both incisions are made to the depth of the cambium. A third

cut is made joining the first two at the top (during the rainy season this third cut may be made at the base). The bud is then removed from the budstick by a single deep cut which also removes part of the wood. The wood is then peeled off, care being taken not to bend the bark and the bud is then shaped to fit the aperture on the stock exactly, with not more than a millimeter on either side and up to 3–4 millimeters at the top, where contamination might occur. The bark flap of the stock is gently pulled back and the bud inserted. The flap is replaced, wrapped with string, taped and waxed at the top of the tape. The tape is removed after 18–21 days and the bud examined. If it is still living, it is marked, re-examined 10 days later and if still alive is considered successful. The seedling stem may be cut off when ready to transplant to the permanent position, although experiments, which are described later in this paper, have shown that cutting back the stem a week before transplanting gives much better results insofar as survival and growth of the bud are concerned.

The patch-bud method always yielded 90–95% success with citrus and also proved satisfactory with rubber, mangoes and avocadoes. It is the method used in grafting *Hevea*.

SCION REACTION

The stocks in the nursery were budded with grapefruit and tangerine grown locally as well as with the introduced varieties mentioned previously. In all cases, percentage of successful union was very high, 90–95%, indicating no inhibiting factors between any stock and any scion. For some of the introduced plants, the number of buds available was insufficient to give more than preliminary results, but there was no noticeable difference on any of the different stocks.

The lime seedlings showed a very bad tendency to produce adventitious buds in great quantities, with consequent inhibition or overshading of the grafted bud, thus requiring considerable pruning. This proliferation of the adventitious buds is so characteristic of lime that it was ruled out as a suitable stock.

TRANSPLANTING FROM NURSERY TO FIELD

None of the stocks showed a very impressive root system. The trees were growing in a uniform red lateritic soil with a large percentage of gravel. It is difficult to show any marked variation between the root systems of these five species, although the vigor of growth of the rough lemon was generally reflected in a more extensive root system. A large primary root with a number of fairly strong laterals seems to be characteristic of the genus. These observations were made on two occasions: one, three trees of each species were dug up and examined during budding operations and two; the root systems were examined during field planting.

Survival of these trees when transplanted seems more dependent upon weather conditions than on kind of stock. When planted during rainy weather, survival is uniformly satisfactory. The soil where these trees are planted is an acid, gravelly laterite. Average rainfall in this part of Liberia is from 120–140 inches a year. Elevation is 100 feet above sea-level and the area is about 25 miles from the Atlantic sea-coast.

NURSERY TREATMENTS TO INDUCE BUD-SPROUTING

An important factor in the growing of citrus is the occasional failure of grafted buds to grow although apparently alive and healthy. On some of these stocks, if thorough pruning of stock shoots is carried out, starvation and death of the stump may occur. Sometimes a few buds from the stock may be allowed to grow to produce a little food. If these buds are kept pruned low and allowed to grow only on the opposite side of the stem from the grafted bud, the grafted bud may eventually be induced to sprout, sometimes as long as several months after planting. Such a method, however, is time-consuming and expensive and the following experiment was designed, on a small scale, to test the effect on bud-sprouting of cutting back the stem of the stock in the nursery before planting in the field. Thirty trees were used, 6 each of Washington Navel orange, Pineapple orange, Rico #2 orange, Marsh Seedless grapefruit, Lisbon lemon and Seedless Persian Lime. All buds were on rough lemon stock. The stocks were cut back in the nursery one month after budding, and allowed to remain *in situ* until the grafted buds began to swell, which they did in seven days. They were then planted in their permanent positions, the oranges in rows 15′ × 15′ and the grapefruit and lemon in rows 20′ × 20′, each variety in a separate row. The remainder of each row was planted with trees of the same variety, cut back and planted on the same day (as is usual practice), a total of 26 trees. Fifteen days later, sprouted buds were counted. Seventeen of the 30 stumps cut back in the nursery and allowed to remain *in situ* for a week before transplanting had sprouted or 56.6% while 10 out of 26 of those cut back and transplanted on the same day had sprouted or 38.4%. It should be emphasized that general growth of the buds allowed to remain in the nursery until they had begun to swell was much better than those planted and cut back on the same day.

This method has the advantage of a longer period of growth during a critical period in the life of the tree, i.e., just after transplanting, less field pruning of adventitious buds and considerably less danger of field dieback.

REJUVENATION OF BUDWOOD

One shipment of budwood sent from Nigeria to Liberia was delayed in transit and the budwood became too dry to bud. The bark would not "peel" and the buds could not be excised without tearing the bark. In the hope of saving some of the budsticks, they were planted as cuttings in a bed of sand under light shade and kept moist. They were 6–8″ long, approximately ⅜″ in diameter and were buried about halfway into the sand. After about two weeks in the bed, some of the buds began to swell and it was found that the bark "lifted" very easily. A few of these buds were grafted in the usual way and "took" very satisfactorily. Buds were then used whenever the bark of the cuttings lifted easily. Percentage of success was always very high. Even buds taken from these cuttings 3 months after they were placed in the sand bed gave excellent results.

It was thus possible to propagate many varieties which did not form roots on cuttings but which lived for several weeks or even months in the cutting bed. Both dormant and swelling buds could be grafted.

Some 20 varieties of oranges, lemons, tangerines and grapefruit were propagated by this method.

It is often necessary, especially in the tropics, to ship budwood long distances, but if it is exposed to excessive drying, it may be possible to "rejuvenate" it by this technique. Although many plants such as *Hevea, Magnifera, Persea*, etc., do not root readily from cuttings, they remain alive for weeks or months in the nursery bed.

DISCUSSION

These experiments established considerable variation in percentage of buddable plants produced, total germination and adventitious bud production in rough lemon, *C. Limonia* Osbeck, sour orange, *C. aurantium* L., common lime, *C. aurantifolia* L., grapefruit, *C. paradisi* Macf., and tangerine, *C. nobilis* Lour.

Cuttings are not feasible for propagation with or without hormone treatment.

Either rough lemon or sour orange may be used for stock. Under Liberian conditions of climate and soil rough lemon should be given preference, at least as far as *early* growth is concerned, since germination is faster, more complete, and more buddable plants are obtained. Cutting back budded plants in the nursery and not planting in the field until the buds swell is found to be more satisfactory than cutting back and planting on the same day. Patch budding gave excellent results with all stocks and scions.

It was found that budwood which is too dry for budding purposes could be "rejuvenated" by planting in moist sand under light shade and keeping moist for a few weeks.

SUMMARY

1. Experiments with growth hormones on cuttings are described.
2. Germination of rough lemon, orange and lime is more rapid and more complete than tangerine or grapefruit. Rough lemon gives the most rapid and complete germination.
3. Rough lemon produced the highest percentage of graftable plants, with sour orange and lime next.
4. Lime trees are not suitable for stock because of the excessive growth of the adventitious buds which necessitate extensive pruning operations.
5. Patch budding gave excellent results with all stocks and all scions.
6. Cutting back budded stock in the nursery until the grafted buds swell encourages growth after transplanting.
7. Dry budwood may be made usable if planted in sand and kept moist for a few weeks. This process is termed "rejuvenation".

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Revision of the Genus Egletes Cassini North of South America

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Egletes is a genus of small, short-lived herbs of the New World tropics, where it takes the place of the Old World *Grangea*. From the latter it differs in having radiate marginal florets, and in lacking a prominently lacerate pappus-like crown on the achene. So closely do the two resemble each other in all other respects—particularly in the conical receptacle, and disk corollas with varying number of lobes—that *Egletes* is certainly to be placed with *Grangea* in the *Compositae-Astereae-Grangeinae* rather than in the *Bellidinae*, as was done by Hoffmann (1894). The latter subtribe as defined by Hoffmann (including genera with radiate florets not yellow, and without well developed capillary pappus) is decidedly heterogeneous and artificial. Of the indigenous New World genera placed there, *Keerlia* is inseparable from *Chaetopappa* in the *Asterinae; Aphanostephus* is unique in its peculiar columnar achenes, and has no very close relatives; *Greenella* is inseparable from *Xanthocephalum*, also in the *Asterinae; Achaetogeron* is not separable from *Erigeron*, again in the *Asterinae;* and *Astranthium* (included in the Old World genus *Bellis* by Hoffmann) is most closely related to *Dichaetophora*, also treated by Hoffmann in the *Asterinae* (for remarks on most of these genera, see the two references by Shinners, 1946). It is indicative of both the order and the complexity of the *Compositae* that although the tribes have been recognized with remarkably little change in circumscription since they were first defined by Adanson and Cassini, their sequence and the arrangement of genera within them has varied, and no really satisfactory system has yet been proposed.

Like most common weeds of roadsides and waste ground, the species of *Egletes* have been slighted by collectors. So scanty is the South American material (except from Venezuela and Colombia) available in North American herbaria that it has been thought best to limit the present revision to the species of Central and North America and the West Indies. I have seen no material of several of the species described from South America. On the other hand, several apparently undescribed species have been collected on that continent. Descriptions of two of these are given in a separate paper (Lloydia, **12** (4): 248-250), together with the original descriptions of those species not discussed here.

Most of the species of *Egletes*, as well as of other small daisy-like genera (*Aphanostephus*, *Bellis*, *Dichaetophora*), are known in Latin America as "margarita," or more fully as "margarita de playa," "margarita de campo," and the like. One collector records the vernacular name "orejona de playa" for *Egletes viscosa* in El Salvador (Depto. de Ahuachapan).

Unforeseen circumstances have delayed completion of this paper more than three years. Special thanks are due the patient and con-

siderate curators of the following herbaria for the loan of their material of *Egletes:*

C	University of California
C-Cl	Clokey Herbarium, University of California
F	Chicago Natural History Museum (formerly Field Museum)
G	Gray Herbarium
Mo	Herbarium of the Missouri Botanical Garden
US	United States National Herbarium

SYSTEMATIC TREATMENT

EGLETES Cassini, Bull. Soc. Philom. (Paris) **1817:** 153. 1817.

Type species: *Egletes domingensis* Cass. = E. PROSTRATA (Swartz) Kuntze.

Xerobius Cassini, Dict. Sci. Nat. **59:** 128–129. 1829. Type species: *X. lanatus* Cassini = EGLETES PROSTRATA (Swartz) Kuntze.

Eyselia Reichenbach, Iconographia Bot. Exot. no. 242, pl. 242. 1830. Type species: *Eyselia bellidiflora* Reichenbach = EGLETES PROSTRATA (Swartz) Kuntze.

Platystephium Gardner, London Journ. Bot. **7:** 80–81. 1848. Type species: *P. graveolens* Gardner = EGLETES VISCOSA (L.) Less.

Short-lived herbs from a taproot. Stems trailing to erect, simple or freely branching, the branches alternate (rarely and exceptionally opposite). Leaves alternate, simple, sessile or petioled, variously toothed or lobed. Pubescence uniform and lanate, or double and of both hispid-hirsute and glandular-capitate hairs (some parts of the plant may exhibit only one type; plants of two species sometimes nearly glabrous). Heads solitary or loosely clustered, short- or long-peduncled; heterogamous, radiate, heterochromous. Involucre urn-shaped; phyllaries equal or slightly unequal, in 2–3 series, acute or acuminate, thinly chartaceous to subfoliaceous. Receptacle conical, naked, glabrous. Ray florets uniseriate or pluriseriate, ligulate, pistillate; ligules white, in some species very narrow or very short and inconspicuous; style simple, narrowly linear or filiform. Disk florets hermaphrodite; corollas yellow, tubular-funnelform or urn-shaped, with rather slight differentiation of tube and limb, 3-, 4-, or 5-lobed; anthers with a short stiff tip, obtuse at base; style branches flat, appendaged, very short. Achenes similar in disk and ray florets, more or less compressed, 2-ribbed, constricted at base. Definite pappus wanting, the summit of the achene extended into a whitish or yellowish cartilaginous crown which in some species is rather broad and flaring.

KEY TO THE SPECIES

1a. Pubescence cottony or woolly (of long, slender, curled or tangled hairs of uniform thickness; sometimes evident only on young parts)...1. *E. prostrata*

1b. Pubescence hispid-hirsute or both hispid-hirsute and glandular-capitate.

- 2a. Ligules relatively broad, 0.4–1.6 mm. wide, either very short or well exserted; ray florets in 1–2 series.
    - 3a. Ligules about 4.5 mm. long........................2. *E. commixta*
    - 3b. Ligules about 1.6–2.0 mm. long.
        - 4a. Achenes 1.2–1.4 mm. long; involucres 2.5–5.0 mm. high; outer phyllaries 0.8–1.6 mm. wide; leaves various; plants of wide distribution in south Texas, Mexico, Central America, and Cuba..................3a. *E. viscosa*
        - 4b. Achenes 1.5–1.7 mm. long; involucres 4.5–6.0 mm. high; outer phyllaries 1.4–2.1 mm. wide; plants of Sinaloa, Mexico..........................3b. *E. viscosa* var. *dissecta*

2b. Ligules very narrow, less than 0.25 mm. wide; ray florets numerous, in 3–4 series.
 5a. Leaves toothed or shallowly lyrate-pinnatifid, the petioles winged and slightly clasping; ligules about 1 mm. long, 4a. *E. Liebmannii*
 5b. Leaves pinnatifid, the petioles broadly winged and auricled-clasping; ligules about 2 mm. long. .4b. *E. Liebmannii* var. *yucatana*

SERIES 1. PROSTRATAE. Indumentum totum lanosum nec hispidum nec glandulosum; flores radii uniseriati longi speciosi. Type species: *E. prostrata.*

1. EGLETES PROSTRATA (Swartz) Kuntze, Rev. Gen. **1**: 334. 1891. Based on *Matricaria? prostrata* Swartz.

Matricaria? prostrata Swartz, Prodr. Veg. Ind. Occ. 114. 1788. Type: Curacao, *Rohr* (not seen).
Pyrethrum simplicifolium Willd., Sp. Pl. ed. 4 vol. 3 pt. 3: 2151. 1803. Renaming of *Matricaria prostrata* Swartz, which is listed as a synonym.
Egletes domingensis Cass., Bull. Soc. Philom. (Paris) 1817: 153. 1817. Type: "Recueillie a Saint-Domingue par M. Poiteau, suivant une note de l'herbier de M. Desfontaines" (not seen, but there is a fragment of a plant of this species in the Gray Herbarium, bearing the name *Poiteau* but no other data; it may well be an isotype).
Xerobius lanatus Cass., Dict. Sci. Nat. **59**: 128–129. 1829. Type: "Un échantillon sec, en très-mauvais état, recueilli par M. Desfontaines parmi les plantes cultivées au Jardin du Roi" (not seen).
Eyselia bellidiflora Reichenbach, Iconographia Bot. Exot. no. 242, pl. 242. 1830. Type: plate 242 of the work cited, drawn from a cultivated plant, grown from seeds which were "e specimine in Insula St. Thomae lecto," very probably a duplicate of the Wydler collection cited by De Candolle and Oersted, under *Egletes domingensis* var. *glabrata* and *E. glabrata* respectively. Reference is made by Reichenbach to an earlier publication of his species in "Mittheil. 1829." According to Wheeler (1942), this cryptic reference is to a series of articles which were published as supplements to a Dresden evening newspaper ("Abend-Zeitung"), vol. 13 ("13. Jahrgang, mit den Beiblättern: Mittheilungen aus der Gebiete der Flora und Pomona, redigirt von H. G. L. Reichenbach"), no copies of which are available in North America. It is questionable whether the 1829 publication was valid.
Egletes bellidiflora (Reichenb.) Lessing, Syn. Comp. 252. 1832. Based on *Eyselia bellidiflora* Reichenb.
Egletes domingensis var. *glabrata* DC., Prodr. **6**: 42. 1838. "Var. glabrum ut videtur perennem in insula Sancti-Thomasii legit cl. Wydler, et eadem forte ad Caracas cl. Vargas" (not seen).
Egletes glabrata (DC.) Bentham ex Oersted, Videnskabelige Meddelelser fra den naturhistoriske Forening i Kjobenhavn for Aaret **1852**: 103–104. 1853. Based on *E. domingensis* var. *glabrata* DC., with reference specifically to the Wydler collection from St. Thomas.
Grangea domingensis (Cass.) Gomez de la Maza, Dicc. Bot. Nom. Vulgares Cubanos y Puerto Riquenos 115. 1889. Also Ensayo Farm. Cuba 85. 1889. (Publications not seen; references copied from Gray Herbarium Card Index.) Based on *Egletes domingensis* Cass.
Egletes prostrata var. *glabrata* [incorrectly attributed to DC. by] Kuntze, Rev. Gen. 1: 334. 1891. Presumably intended to be a transfer of *E. domingensis* var. *glabrata* DC., but a *nomen nudum* as actually published.

Flowering the first year from seed, but surviving for an indefinite period, exhibiting several seasonal forms. Most luxuriantly developed phase from August to November, or at other seasons when grown in gardens; second phase mainly from January to June.

First phase: Stems several or many, glabrous except on youngest parts or sparingly floccose, trailing and with ascending tips, branches, and peduncles, 15–50 cm. or more long; producing adventitious roots.

Nodes more remote than in the second form, the internodes 1.0–3.3 cm. long. Leaves spatulate with long-cuneate petiolar base, 1.6–15.0 cm. long, 0.8–6.0 cm. wide (largest measurements from garden plants), broadly obtuse, closely dentate to coarsely laciniate-dentate in the apical ⅓–⅔, rather prominently feather-veined. Peduncles solitary, opposite stem leaves or terminal, naked or occasionally with a single small bract near the head, ascending, 1.5–7.0 cm. long in flower, glabrous or sparingly floccose. Heads solitary and terminal on the peduncles. Involucres broadly urn-shaped, 3.5–5.0 mm. high; disk 7–10 mm. across (as pressed). Phyllaries imbricated in 2–3 series, the outer about ¾ as long as the inner, subfoliaceous, lanceolate, about 1.1 mm. wide, glabrous or minutely granulose, sparingly and shortly hispid-ciliate, acute; inner phyllaries similar but with hyaline margins more or less lacerate-ciliate toward apex. Ray florets 16–28, in 1 series or nearly so, rather showy; ligules 4–5 mm. long, 1.0–1.5 mm. wide, oblong- or elliptic-lanceolate, obtuse, denticulate or distinctly 3-toothed at apex; tube pubescent toward summit with rather short jointed hairs. Disk corollas about 2 mm. long (tube cylindric, 0.25 mm.; limb urn-shaped or slightly funnel-form, not always well differentiated, 1.25 mm., including lobes); lobes 5, narrowly deltoid, spreading, unequal, about 0.6 mm. long. Achenes 1.5–1.8 mm. long, loosely strigose with glochidiate hairs and coarsely resin-dotted, the deeply cupped cartilaginous summit ¼–⅓ the total length at maturity, the erect rim slightly uneven.

Second phase: Plants smaller, sometimes flowering apparently as merely seedlings a few centimeters tall and erect, but usually more bunched and matted, the stems short and more branched, the internodes 0.5–1.5 cm. long, woolly-pubescent, sometimes densely so, but becoming glabrous. Base of plant with a few large leaves, but the stem leaves small, up to 2.5 cm. long, 1.5 cm. wide, closely and sharply dentate, loosely to densely lanate, later glabrate, withering before flowering is over. Peduncles more numerous, shorter, 0.3–3.5 cm. long. Stems commonly producing many short, lanate, leafy branchlets when most of the primary leaves have fallen, with small crowded leaves as little as 0.5 cm. long, 0.5 cm. wide.

A common weed of ditches, dried-up pond bottoms, low waste ground, and beaches, also found in cultivation as an ornamental, in the Lesser Antilles and at lower elevations in the coastal region of Colombia, Venezuela, and British Guiana on the South American mainland (collections from the latter region not cited here). Specimens seen:

ANTIGUA. "Roadsides and waste places, especially on the clay bluffs of the central region, frequent but rather local," *Harold E. Box 1057* (US).

BARBADOS. "Along roads," *Warming 714* (US).

CURACAO. Piscadera Bay, *Britton & Shafer 3129* (US). Santa Cruz, *Britton & Shafer 3011* (F, US). Willemstadt, *Eggers 16011* (F, G). "Coastal strip," *Killip & Smith 21071* (G, US). Without definite locality, *Curran & Haman 81* (C, G, US).

DOMINICA. Portsmouth, *Hodge 773* (G).

GUADELOUPE. (First word illegible) Boissard, *Questel 664* (US). Marie-Galante, *Stehle 158* (US). Pointe a Pitre, *Questel 498* (US). Without definite locality, *Grisebach*, in 1857 (Mo); *Dr. Madiana*, without date or number (G).

MARTINIQUE. Fort-de-France, *Hahn 108* (G), *1225* (C, G, US). Grand' Anse, *Pere Duss, Herbier de la Martinique no. 956* (US). Without definite locality, *Hahn 1205* (C-Cl).

ST. KITTS. Canada Estate, *Britton & Cowell 356* (US).

ST. THOMAS. Flyderokkens Arbeidsplads (? writing barely legible), *Eggers*, April 19, 1876 (G). Hopewell, *Barbados Botanic Station Herb. no. 435* (F, US). Kasernhaven, *Eggers 22* (G). Longbay, *Eggers 45* (C). Without definite locality, *Eggers 28* (F); "*Distrib. Baron Eggers*," Dec., 1882 (US); *Oersted*, without number or date (G).

TRINIDAD. Moruga, planted as a garden flower, *Britton & Broadway 2429* (G, US). Toco, Pt. Galera, *Broadway 7819* (Mo).

SERIES 2. COMMIXTAE. Indumentum duplex hispido-hirsutum atque glandulosum sicut *Viscosis;* caules plerumque subdecumbens, flores radii uniseriales sat longi speciosi sicut in *Prostratis*. Type species: *E. commixta*. (Two South American species also belong to this series.)

2. **Egletes commixta** Shinners, sp. nov. TYPE: Tobago, Castara, growing along the roadside, *W. E. Broadway 4149*, Sept. 30, 1911 (G; isotype US).

Caules basi vel omnino decumbentes cumque foliis obovatis vel spatulatis hispido-hirsuti atque glanduloso-pubescentes. Flores radii uniseriales speciosi ligulis ca. 4.5 mm. longis, 1.6 mm. latis.

Stems erect or ascending from partly decumbent bases, or almost wholly decumbent with ascending tips, remotely branched, 15–45 cm. or more long, hispid-hirsute with coarse jointed translucent and somewhat tangled hairs 0.7–1.5 mm. long, and puberulent with short glandular-capitate hairs 0.1–0.3 mm. long, or puberulent only or even glabrate except on young shoots and peduncles. Basal leaves (soon withering; seen on one specimen only) oval to suborbicular, 4–6 cm. long, 3.0–4.5 cm. wide, with abruptly narrowed wing-petiolar base 2–3 cm. long, coarsely toothed. Stem leaves obovate or spatulate, 3–7 cm. long, 1-3 cm. wide, closely to laciniately dentate or shallowly lyrate-pinnatified, with narrow wing-petiolar base, coarsely hirsute (usually sparsely so except on the veins beneath) and glandular-pubescent (usually rather densely so). Leaves of branches smaller, oblong-lanceolate, lanceolate-elliptic, or spatulate, less deeply toothed. Peduncles 1–6 cm. long, solitary, arising opposite the leaves. Involucres 4.5–6.5 mm. high; disk 6.0–8.5 mm. across (as pressed). Phyllaries lanceolate, subequal, 1.5 mm. wide, rather thin, glandular-pubescent or both pubescent and hirsute, narrowly acute or acuminate, glandular-ciliate, hyaline-margined in the lower ⅔. Ray florets 23–33, in one series, rather showy; ligules lanceolate-elliptic, obtuse, 4.5 mm. long, 1.6 mm. wide; tube 1.3–1.4 mm. long; style branches 0.3 mm. long. Disk corollas 1.6–1.8 mm. long, limb and tube not well differentiated; lobes 5, unequal, 0.4–0.5 mm. long; style branches 0.35 mm. long. Achenes 1.1–1.3 mm. long, pubescent with glochidiate hairs. Cartilaginous crown short, rather thick and blunt, erect or somewhat spreading, slightly uneven.

Superficially very similar to *E. prostrata*, but coarser, and with the indument of the other species of the genus, quite unlike the lanose pubescence of *E. prostrata*. Specimens examined:

GUADELOUPE. "Port Louis et l'Anse," and (apparently added later, in another ink) "St. Francois, Sainte Anne," *Pere Duss, Herbier de la Guadeloupe et Dependences No. 3386* (US).

VENEZUELA. Istmus de Medanos, Paraguana, *Francisco Tamayo 956* (US). "N. v. Manzanillo de Pozo. Yerba rastrera. Forma colonias extensas en las orillas de los pozos y ciénegas."

SERIES 3. VISCOSAE. Indumentum duplex hispido-hirsutum atque glandulosum; flores radii uniseriales ligulis brevibus latis. Type species: *E. viscosa.* (Probably several South American species belong to this series.)

3a. EGLETES VISCOSA (L.) Lessing, Syn. Comp. 252. 1832. Based on *Cotula viscosa* L.

Cotula viscosa L., Sp. Pl. **2**: 892. 1753. Based on "Jacobaea americana odorata viscosa, florum radiis brevissimis albis. *Houst. mss.*"; from Vera Cruz, Mexico (specimens not seen).

Grangea domingensis var. *viscosa* (L.) Gomez de la Maza, Dicc. Bot. Nom. Vulgares Cubanos y Puerto Riquenos 115. 1889. Also Ensayo Farm. Cuba 86. 1889. (Publications not seen; references copied from Gray Herbarium Card Index.) Based on *Cotula viscosa* L.

Egletes viscosa f. **bipinnatifida** Shinners, f. nov. Foliis bipinnatifidis lobis acute dentatis. TYPE: Vento, Havana Province, Cuba. *A. H. Curtiss W. Ind. Pl. 697* (G; isotypes F, US).

Stems subsimple on small plants, bushy-branched on larger ones, erect or ascending, 12–60 cm. high, terete, striate, hispid with widely spreading, flat, jointed, translucent hairs 1.0–3.0 mm. long, and pubescent with short, widely spreading, glandular-capitate hairs 0.1–0.5 mm. long, very densely so in the upper part and on the branches. Stem leaves (withering before flowering is over) oblong or oboval in outline, 4–11 cm. long, 2–6 cm. wide, shallowly to deeply pinnatifid or bipinnatifid, the divisions coarsely toothed, the lower ones with narrow auricled-clasping petiolar base a third the total length. Leaves of branches smaller, relatively narrower, less deeply divided, the basal third often entire. Ultimate branchlets or peduncles short, 0.2–20 cm. long (longer ones with a small leafy bract), shorter than the small leaves in whose axils they arise; heads rather numerous and crowded toward the tips of the branches. Involucres 3.3–4.0 (rarely 2.5–5.0) mm. high; disk 4–6 mm. across (as pressed). Phyllaries in 2 rows, about equal, 0.8–1.6 mm. wide, lanceolate to ovate-lanceolate, acute, hispid and glandular-pubescent. Rays 18–28, in 1 series, usually shorter or but slightly longer than the phyllaries; ligules oblong-elliptic, erect, 1.6–2.0 mm. long, 0.6–0.75 mm. wide; tube 0.6–0.9 mm. long; style branches lanceolate, 0.25 mm. long. Disk corollas 1.3–1.6 mm. long, tubular-funnelform, limb and tube not well differentiated; lobes 4 or 5, about 0.35 mm. long; style branches 0.2–0.4 mm. long, the appendages about a fourth as long. Achenes 1.3–1.4 mm. long, glandular-puberulent, with a narrow uneven cartilaginous ring around the summit.

Egletes viscosa is the only species of the genus known from the United States, occurring from extreme southern Texas through most of Mexico, and in Central America and Cuba. It is the most wide-ranging and variable of the species treated here, and at first was tentatively divided into several segregates. After attempting without success to construct a workable key to distinguish them, it was concluded that they are most probably only growth forms or at best varieties of a single species. In Cuba, plants with large, bipinnatifid leaves are most commonly collected, but apparently indistinguishable forms occur in Mexico. The only variant with fairly tangible differ-

entiating characters in addition to difference in leaf form is the Sinaloan plant described below as var. *dissecta*. Specimens examined:

UNITED STATES. TEXAS: Cameron Co., vicinity of Brownsville, *Ferris & Duncan 3123* (Mo, US); near edge of resaca at Palm Grove, *Runyon 1423* (US). Hidalgo Co., Lake Hackney, McAllen, *C. E. R. Cameron*, June, 1937 (F).

MEXICO. CHIAPAS: Hacienda Petapa, *Seler & Seler 2120* (G). COLIMA: Manzanillo, *Palmer 1389* (G, US). NAYARIT: vicinity of Acaponeta, *Rose, Standley & Russell 14234* (US); near Mazatlan, *Gregg 1197* (G, Mo); Mexcaltital, *Ortega 5526* (US), *5528* (US). SINALOA: vicinity of Rosario, *Rose, Standley & Russell 14602* (US). TAMAULIPAS: vicinity of Tampico, *Palmer 216* (G, Mo, US). VERA CRUZ: La Purga, *Greenman 257* (G). STATE NOT DETERMINED: "En route from San Luis Potosi to Tampico," *Palmer 1092* (US).

COSTA RICA. Vicinity of Puntarenas, *Maxon & Harvey 7852* (US). Without definite locality, *Oersted* (G).

EL SALVADOR. DEPT. AHUACHAPAN: without definite locality, *Padilla 335* (US).

GUATEMALA. DEPT. ESCUINTLA: Hacienda las Fanzas, *Salas 375* (US). DEPT. JUTIAPA: Lago Atescatempa, south of Asuncion Mita, *Steyermark 31872* (G). DEPT. ZACAPA: Zacapa, *Deam 164* (G).

NICARAGUA. Granada, *Baker 2561* (G). Hacienda Santa Rosa, *Oersted 9717* (US). Without definite locality, *Wright* (G, US).

CUBA. CAMAGUEY PROVINCE: "Queen City to Riverside," *Shafer 1158* (F, US). HAVANA PROVINCE: near Rincon, *Van Hermann 552* (F, US). (Also type of f. *bipinnatifida*, cited above.) PINAR DEL RIO PROVINCE: Herradura, *Earle 644* (F, US); vicinity of Herradura, *Britton & Earle 6569* (US). SANTA CLARA PROVINCE: vicinity of Sancti Spiritus, *Shafer 12153* (F, US); vicinity of Soledad, *Howard 4836* (G); "Limones, Soledad, Cienfuegos," *Jack 5884* (US). WITHOUT LOCALITY, *Wright, 2865* (G, Mo, US); *3614* (G); *Poeppig* (Mo); *Ramon de la Sagra, Herb. Richard 208* (G).

3b. **Egletes viscosa** var. **dissecta,** Shinners, var. NOV. TYPE: El Zapate, Sind. El Quelite, Munic. Mazatlan, Sinaloa, Mexico, *Jesus Gonzalez Ortega 5156*, Julio, 1923 (G; isotype US). Additional specimen seen: Vicinity of Mazatlan, Sinaloa, *Rose, Standley & Russell 13808* (US).

Foliis profunde pinnatifidis segmentis angustis; capitulis majoribus involucris 4.5–6.0 mm. altis.

Leaves deeply pinnatifid, with narrow segments. Heads larger than in the species, the involucres 4.5–6.0 mm. high; achenes 1.5–1.7 mm. long. *Egletes viscosa* var. *dissecta*, with rather finely cut leaves, is quite distinctive in appearance, and when better known may warrant treatment as a distinct species.

SERIES 4. LIEBMANNIANAE. Indumentum duplex hispido-hirsutum atque glandulosum; flores radii multi pluriseriales ligulis angustissimis. Type and only known species of this series: *E. Liebmannii*.

4. EGLETES LIEBMANNII Sch. Bip., Leopoldina **23**: 88. 1887. TYPE: Papantla, Mexico, *Liebmann 277*, June, 1841 (at Copenhagen, not seen; isotype US, sketch of type G). Name earlier published without description by Hemsley, Biol. Cent.-Am. Bot. **2**: 117. 1881.

Egletes Pringlei Greenman, Field Mus. Publ. Bot. **2**: 265–266. 1907. Type: River banks, Las Palmas, San Luis Potosi, Mexico, *Pringle 3531*, June 4, 1890 (F; isotypes G, US).

Stems erect, usually branching widely from near the base, 20–35 cm. high, up to 30 cm. in diameter. Stem and branches pubescent with glandular-capitate hairs 0.1–0.5 mm. long, in the upper parts mixed

with a few jointed translucent hairs 0.5–1.2 mm. long. Stem leaves petioled, the petioles 1.0–2.5 cm. long, narrowly winged, the wings widened to a slightly auricled-clasping base; blades rather thin, rhombic to oblong-oval, 3.5–7.0 cm. long, 2.5–4.5 cm. wide, coarsely, irregularly and rather sharply dentate or lyrate, rather sparsely glandular-pubescent on both surfaces, with long flat jointed hairs on the midrib beneath and on the petiole. Leaves of branches smaller, short-petioled or merely cuneate at base. Heads rather crowded toward the ends of the branches, the ultimate branchlets or peduncles 3–8 mm. long. Involucres 3.5–4.5 mm. high; disks 5.0–6.5 mm. across (as pressed). Phyllaries in 2–3 series, nearly equal (occasionally with 1 or 2 narrower, oblong, subfoliaceous outer ones), lanceolate, about 1.0–1.4 mm. wide, narrowly acute, glandular-pubescent and rather sparsely hirsute, the inner hyaline-margined. Ray florets numerous, in 3–4 series; ligules narrowly linear, obtuse, about 1 mm. long, 0.15 mm. wide (in dried specimens looking much like a style-branch); tube about 0.8 mm. long; style simple, exserted about 0.6 mm. Disk corollas about 1.2 mm. long; tube cylindric, about ⅓–½ the total length, limb urn-shaped; lobes 4 or less commonly 5, about 0.2 mm. long; style branches acute, about 0.1 mm. long. Achenes 1.0–1.1 mm. long, glandular-pubescent, the cartilaginous summit at maturity prominently flared and shallowly cupped, its diameter greater than that of the body of the achene.

A peculiar and rather restricted species of east-central to southeastern Mexico. Specimens examined:

MEXICO. SAN LUIS POTOSI: Las Palmas, *Pringle 3531* (F, type, and G, US, isotypes of E. Pringeli); *4101* (C, G, Mo, US). TABASCO: "Camins de Tierra colorada," *Rovirosa 195* (US). VERA CRUZ: Ojapa, *Orcutt 5140* (Mo, US); Sanborn, *Orcutt 2983* (G, Mo, US); Tlacotalpam, *Nelson 510* (US).

4b. **Egletes Liebermannii** var. **yucatana** Shinners, var. nov. TYPE: Tuxpena, Campeche, Mexico, *C. L. Lundell 1263*, Jan. 28, 1932 (G; isotypes C, F, Mo, US). According to the collector's notebook, a "small soft-leaved Composite with white flowers. . . . Open clearings and roads, widely distributed" (these data not given on any of the herbarium labels).

Foliis caulinis petiolis late alatis basi auriculatis, laminis pinnatifidis; capitulis ligulis majoribus ca. 2 mm. longis.

Whole plant generally taller than in the species. Stem leaves with broadly winged and auricled-clasping petioles, and pinnatifid blades. Ray florets more prominent, the ligules about 2 mm. long. Replacing the species from the southern Yucatan Peninsula into nearby Central America. Specimens examined:

MEXICO. CHIAPAS: Tonala, *Seler & Seler 1851* (G). OAXACA: Ubero, *L. Williams 9193* (G).

BRITISH HONDURAS. Corozal District, "Corozal-San Antonio Road," *Gentle 802* (US). "Belize River, Double-head Cabbage bank," *Lundell 1953* (US).

GUATEMALA. DEPT. PETEN: Along Río Cancuen between bluffs above Tres Islas and La Cumbre, *Steyermark 46012* (F). Sayaxché, *Steyermark 46253* (F, G). Uaxactum, *Bartlett 12132* (US). DEPT. SANTA BARBARA: Río Permejo, *C. Thiene "ex plantis guatemalensibus . . . edidit John Donnell Smith 5302,"* (G. US).

HONDURAS. DEPT. ATLANTIDA: La Fraguera, *Standley 52668* (US), *55690* (US).

EXCLUDED SPECIES

The species described from South America are listed with original descriptions in a separate paper.

E. arkansana (DC.) Nutt., Trans. Amer. Philos. Soc. n.s. **7**: 394. 1841. =APHANOSTEPHUS SKIRRHOBASIS (DC.) Trel.

E. californica Kellogg, Proc. Calif. Acad. Sci. **1**: 56 1873. =?ERIOPHYLLUM LANATUM (Pursh) Forbes var. GRANDIFLORUM (Gray) Jepson (fide Constance, Univ. Calif. Publ. Bot. **18**: 89, 1937).

E. humilis (Benth) T. & G., Fl. N. A. **2**: 411. 1843. =APHANOSTEPHUS HUMILIS (Benth.) Gray.

E. ramosissima (DC.) Gray, Pl. Fendl. (Mem. Amer. Acad. n.s. **4**:) 71. 1849. =APHANOSTEPHUS RAMOSISSIMUS DC.

E. texana Engelm. ex Gray, Pl. Lindh. **1**: 14 (Boston Journ. Nat. Hist. **5**: 222.) 1847. (As synonym of *Aphanostephus arkansanus*.) =APHANOSTEPHUS SKIRRHOBASIS (DC.) Trel.

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Hoffmann, O. (*Compositae-Astereae*, key to subtribes; subtribe *Bellidinae*.) Engler & Prantl, Die Natürlichen Pflanzenfamilien Teil IV, Abt. V: 143, 154. 1894.

Shinners, Lloyd H. Revision of the genus *Chaetopappa* DC. Wrightia **1**: 63–81. 1946.

———. The genus *Dichaetophora* A. Gray and its relationships. Wrightia **1**: 90–94. 1946.

Wheeler, Louis Cutter. *Hugelia* Bentham preoccupied. Journ. Washington Acad. Sci. **32**: 237–239. 1942. (Bibliographic note on Reichenbach's Mittheilungen, p. 238.)

Two Additions to the Genus Egletes Cassini from Northern South America

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Egletes (series *Commixtae*) **florida** Shinners, sp. nov. TYPE: Between San Jose and Rio Chico, Barlovento, Miranda State, Venezuela, *H. Pittier 6357*, June 16, 1913 (U. S. National Herbarium).

Planta erecta 25–50 cm. alta, superne ramosa glanduloso-pubescens et parce hirsuta. Folia inferiora obovalia sublyrata et dentata subpetiolata. Involucra 4.2–5.5 mm. alta. Flores radii 20–25 sat speciosi ligulis lanceolato- vel elliptico-oblongis, 3–4 mm. longis.

First phase: Stems erect, 25–50 cm. or more high, branching chiefly in the upper ⅔, glandular-pubescent with short hairs 0.1–0.5 mm. long, and rather sparsely hirsute with jointed hairs 0.6–1.1 mm. long. Lower stem leaves (soon withering; seen on few specimens) oboval, shallowly lyrate and coarsely dentate, with narrow petiolar bases scarcely clasping, up to 7 cm. long. 3.8 cm. wide, rather sparsely hirsute on the upper surface, both glandular-pubescent and hirsute on the lower. Upper stem leaves similar, smaller, with slightly auricled-clasping bases. Heads solitary. Peduncles at first short, becoming 0.5–4.0 cm. long in flower, naked or with a single small leafy bract 3–6 mm. long. Involucres 4.2–5.5 mm. high; disk 5.0–7.5 mm. across in flower, up to 9 mm. in fruit (as pressed). Phyllaries lanceolate, acute, in 2–3 series, the outer equal to or slightly shorter than the inner, 1.3–1.4 mm. wide, green and herbaceous except at base, glandular-pubescent and hirsute. Rays about 20–25, in 1 series, rather showy; ligules lanceolate- or elliptic-oblong, obtuse or emarginate, 3–4 mm. long, 1.3–1.5 mm. wide; tube narrowly cylindric, 1.4 mm. long. Disk corollas about 2.4 mm. long; tube 1.1 mm., limb (including lobes) 1.3 mm.; lobes 4 or 5, about 0.5 mm. long; style branches 0.3 mm. long, acute, the appendages about ¼ the total length. Achenes seen only on specimens of second form.

Second phase: More freely branching, both stem and leaves rather densely glandular-pubescent and hirsute. Stems partly decumbent or erect. Leaves rather small (lower ones withered), about 1.0–2.5 cm. long, 0.6–1.5 cm. wide, numerous, oblong-spatulate with rather broad bases, crenate or crenate-dentate in the upper half or less, rather densely hirsute on both surfaces. Heads numerous, appearing racemose-paniculate; peduncles averaging shorter and of more uniform length, 0.6–2.0 cm. long. Ray florets as many as 34. Achenes 1.4 mm. long, tipped by a narrow, dark, cartilaginous ring.

VENEZUELA. BOLIVAR STATE: Las Bonitas, common along bank of river Orinoco in the open, *L. Williams 12960* (US). "Chuapo, Temblador, Medio Caura, se estima infusion como medicina en las enfermedades del estómago," *L. Williams 11681* (US). MIRANDA STATE: Río Chico, *Jahn 1218* (US). BARINAS STATE: Llanos de Barinas, *Jahn 208* (US).

Egletes (Series *Commixtae*) **repens** Shinners, sp. nov. TYPE: Río Casanare, Esmeralda, Colombia, *Cuatrecasas 3922*, Oct. 19–20, 1938 (U. S. National Herbarium).

E. floridae valde affinis, differt caule repente rhizophoro, foliis profunde lyrato-pinnatifidis.

Very closely related to *E. florida*, differing in having prostrate and rooting stems, and deeply lyrate-pinnatifid leaves. This is recognized as a distinct species with some hesitation because of the very scanty material seen. A second collection doubtfully placed here, but which may be only a form of *E. florida* much altered by burial under mud, is *Pittier 12339*, Llanos de la Rubiera, Guarico, Venezuela, April 13, 1927 (Mo., US).

In addition to the above, three of the species treated in the preceding *Revision of the genus Egletes Cassini north of South America* (Lloydia **12** (4): 239-247) are also found in that continent: *E. prostrata* (Swartz) Kuntze, in Colombia, Venezuela, and British Guiana; *E. commixta* Shinners, in Venezuela; and *E. viscosa* (L.) Less., in Bolivia, Brazil, and probably elsewhere. Since the original descriptions of all the South American species were assembled in connection with work on the more northern species, they are reproduced here for the convenience of future students of the genus. Grateful acknowledgment is due three patient and obliging librarians for assistance in obtaining several of these descriptions: Miss Nell C. Horner, of the Missouri Botanical Garden; Miss Ruth D. Sanderson, of the Gray Herbarium; and Mrs. Lazella Schwarten, of the Arnold Arboretum.

EGLETES FLORIBUNDA Poeppig in Poeppig & Endlicher, Nov. Gen. et Sp. 3: 50. 1845.

E. villoso pubescens; caule suffruticoso, erecto ramosissimo; foliis cuneato oblongis; inciso dentatis; ligulis oblongis, emarginatis; corollis disci quinquedentatis, pilosis; acheniis glandulosis.

Crescit in insulis arenosis fluminis Amazonum ad Coary.

(Note: The statements "caule suffruticoso," and "corollis disci . . . pilosis," suggest that this probably is not a species of *Egletes*.)

EGLETES HUMIFUSA (Willd.) Less., Syn. Comp. 252. 1832. Based on *Cotula humifusa* Willd. ms. (Species 2, "praecedenti," is *E. domingensis* = E. PROSTRATA.)

. . . tertia E. humifusa n. sp. *Cotula humifusa* W. hrb. N. 16302, ab ill. de Humboldt prope Guayaquil lecta, ramosissima atque praecedenti simillima, cui sunt capitula globosa, numerosa sed multo minora, corollae punctatae, disco 3-dentatae, radio lingulatae, ligula emarginata, tubo breviori obovata; achaenia teretiuscula, bicostata, punctata, inferne sparse pilosa, obconica; quarta E. viscosa . . .

EGLETES OBOVATA Benth. ex Oersted, Videnskabelige Meddeleser fra den naturhistoriske Forening i Kjöbenhavn for Aaret **1853**: 103. Based on Oersted's collections.

159. Egletes obovata sp. n., herbacea viscida, parce pilosa, ramosissima, foliis obovatis cuneatisve inciso-dentatis viridibus, ligulis integris, achaenio compressiusculo, corollis disci 4dentatis. Quoad folia et indumentum cum charactere E. humifusi convenit, sed flores et achaenia E. viscosae.

Jeg fand denne Art voxende sammen med den foregaaende imellem Granada og Nicaragua.

EGLETES VISCOSA var. SPRUCEI Baker in Martius, Fl. Bras. **6** (3): 20. 1882.

Var. SPRUCEI *Baker*, folia minus profunde dissecta. Cupula apicalis achaeniorum minuta inconspicua.

. . . —Var. — *prope Obidos: Spruce n.* 469! *Trail n.* 468.

PLATYSTEPHIUM GRAVEOLENS Gardner, London Journ. Bot. 7: 80–81. 1848. Based on collections made in Brazil.

PLATYSTEPHIUM, *Genus novum.*

Char. Gen. *Capitulum* multiflorum, radiatum, floribus *radii* uniseriales, ligulatis, foemineis, *disci* tubulosis hermaphroditis. *Involucrum* campanulatum, biseriale, squamis lanceolatis acutis. [p. 81.]

Receptaculum conicum. nudum. *Styli radii* valde exserti, bifidi, ramis obtusis, disci inclusi breviter bilobi, lobis complanatis obtusis. *Achaenia* oblonga, compressiuscula, margine laeviter costata, sparse pilosa, apice truncata, in disco magno dilatata, pappo coroniformi instructa.—Herba *Brasiliensis*, Grangeae *facie, odorata, annua, dichotomo-ramosa;* foliis *alternis, sessilibus, basi biauriculatis, bipinnatifidis, lobis obtusis mucronatis;* capitulis *solitariis, hemisphericis, in pedunculis oppositifoliis.*

1739 et 2651. Platystephium *graveolens*, Gardn.

HAB. In the dried up sandy beds of streams near Ico, Province of Ceara (1739), and in shady places near Paranagoa, Province of Piranhy (2651). Fl. July-Oct.

DESCR. Herba annua, dichotomo-ramosa, subpedalis. Rami teretes, striati, villoso-hirsuti, foliosi. Folia alterna, sessilia, basi amplexicaulia, obtusa, bipinnatifido-lobata, lobis latis obtusis mucronatis utrinque hirsutis, sesquipollicaria, 8–10 lin. lata. Pedunculi oppositifolii, teretes, villosi, 3 lin. longi. Capitula solitaria, multiflora, 3 lin. lata.

The plant on which I establish this genus has quite the habit of *Grangea*, and agrees with it, besides, in several points of structure; but the single series of ligulate florets prevents it from being associated with the *Baccharideae*, and removes it to the subtribe *Asterinae*, and its situation seems to be between *Myriactis* and *Garuleum*. The plant in all its parts has a powerful smell of Chamomile, and it is used as a substitute for it by the inhabitants of the districts in which it grows.

(Note: Most probably this should be listed as a synonym of *E. viscosa*, as is done in *Index Kewensis*.)

Studies in the Gasteromycetes XVIII. The Phalloids of the Southwestern United States Supplementary Note

W. H. Long and David J. Stouffer

In the final preparation of the manuscript under the above title (Lloydia **11**: 57–76. 1948), a final page dealing with the genus *Dictyophora* was inadvertently omitted, although the illustrations (Figs. 20 and 21) were included. The treatment of this genus as prepared by the authors follows:

Dictyophora Desv. Jour. de Bot. **2**: 92. 1809.

Sporophore when young (egg stage) subglobose to ovate with a basal rhizomorph. *Stipe* hollow, with a sheathing volva at base. *Pileus* apical, strongly reticulate to rugulose. *Indusium* prominent, net-like, attached at the stem apex and projecting downward nearly to the volva. *Spore mass* greenish black, foetid, on outer surface of pileus. Spores smooth, elliptical. *Basidia* 6–8 spored. This genus differs from *Phallus* in its prominent indusium.

10. Dictyophora duplicata (Bosc) E. Fischer in Sacc. Syll. Fung. **7**: 6. 1888.

Phallus duplicatus Bosc Mag. Ges. Nat. Freunde Berlin **5**: 86. 1811.
Hymenophallus duplicatus Nees Syst. Pilze u. Schwämme, p. 251. 1816–1822.
Hymenophallus togatus Kalchbr. Ungar. Akad. Wissensch. Budapest **13**: 6. 1884.

Figs. 20, 21

Sporophore when young (egg stage) subglobose, 3–5 cm. in diameter with a pinkish tinge and a strongly radicating base. *Stipe* stout, 8–10 cm. tall, cylindrical, hollow, white, walls thick with several layers of chambers, which open to the outside of the stem. *Pileus* campanulate, 4–5 cm. long, surface sculptured with strong reticulated ridges and crests, which pass into the rounded border or collar where it is united to the apex of the stem. *Indusium* white to pale rosy pink, strongly perforate, about 5 cm. long with a membranous secondary white veil clinging to the stem. *Meshes* of indusium becoming smaller toward the lower border with the bars somewhat wider. *Gleba* dark green with a very foetid odor. *Spores* smooth, elliptic, 2–3 × 3.5–4 mu.

Habitat: In leaf debris.

Distribution: New Mexico, near Tres Ritos in Gallegos Canyon, 8200 ft. elevation, Oct. 1914, *W. H. Long*, 9012.

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New families, genera, species, etc., are indicated by *italics*.